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THE USE OF NATURAL GAS AT PITTSBURG.

It has only been within the past few years that natural gas has been utilized to any extent, in either Pennsylvania or New York. Yet its existence has been known since the early part of the century. As far back as 1821, gas was struck in Fredonia, Chautauqua County, N. Y., and was used to illuminate the village inn when Lafayette passed through the place some three years later. Not a single oil well of the many that have been sunk in Pennsylvania has been entirely devoid of gas, but even this frequent contact with what now seems destined to be the fuel of the future bore no fruit of any importance until within the past two or three years.

It had been used in comparatively small quantities previous to the fall of 1884, but it was not until that time that the fuel gave any indication of the important role it was afterward to fill. At first ignored, then experimented with, natural gas has been finally so widely adopted that to-day, in the single city of Pittsburg, it displaces daily 10,000 tons of coal. The change from the solid to the gaseous fuel has been made so rapidly, and has effected such marked results in both the processes of manufacture and the product, that it is no exaggeration to say that the eyes of the entire industrial world are turned with envious admiration upon the city and neighborhood blessed with so unique and valuable a fuel.

Where the gas comes from, and how long it is going to last—and where it is going to, we might add, now that the scheme of piping it to distant cities is under consideration—are questions which involve so many elements for discussion that we do not propose to take them up at present. The manner of distributing and utilizing the gas, and the industrial revolution its introduction has effected, are more than sufficient to occupy our space. As many of these facts are still involved in mystery to a large majority of our readers, it will, perhaps, be advisable to start at the well itself, and from there follow the gas in its various wanderings until it is finally consumed in the mills and works or in the home.

The regions in which natural gas is found are for the most part coincident with the formations producing petroleum. This, however, is not always the case; and it is worthy of notice that some districts which were but indifferent oil-producers are now famous in gas records. The gas driller, therefore, usually confines himself to the regions known to have produced oil, but the selection of the particular location for a well within these limits appears to be eminently fanciful. The more scientific generally select a spot either on the anticlinal or synclinal axis of the formation, giving preference to the former position. Almost all rock formations have some inclination to the horizon, and the constant change of this inclination produces a series

(*Continued on page* 132.)

THE USE OF NATURAL GAS AT PITTSBURG.

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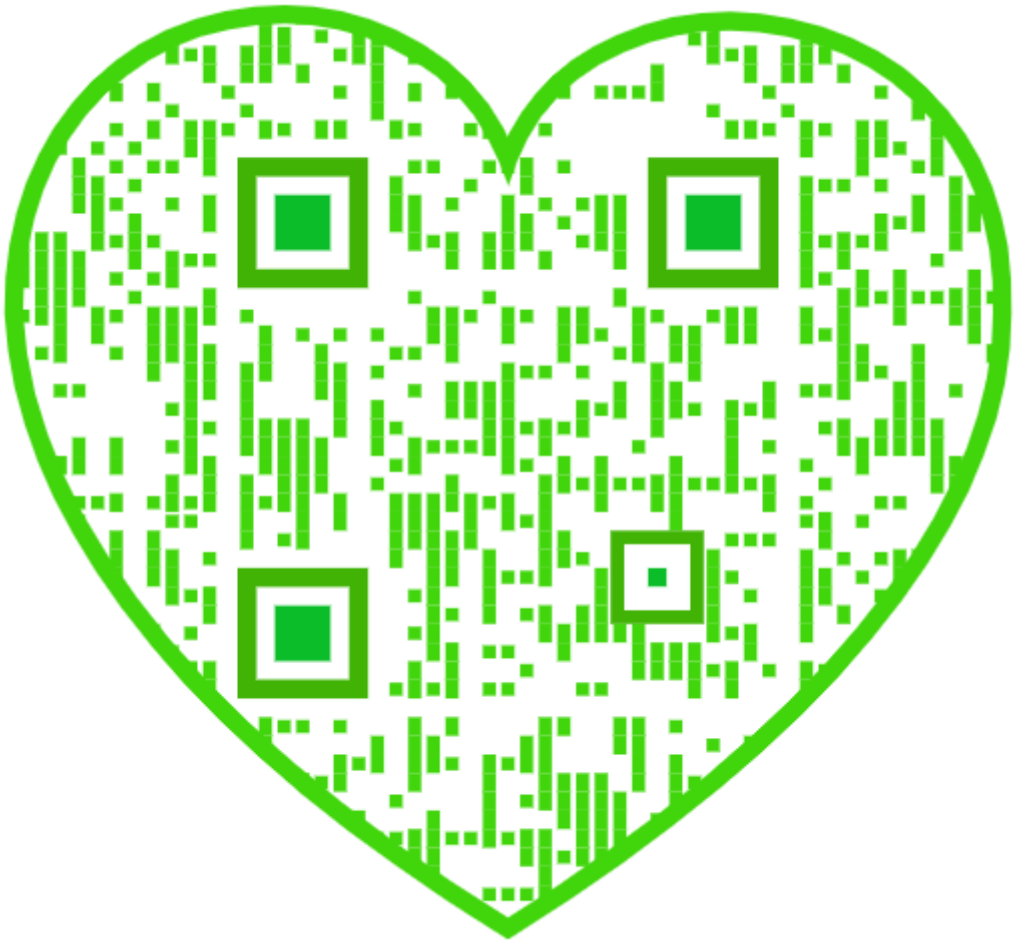

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NEW YORK, SATURDAY, FEBRUARY 27, 1886.

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THE LA GUAYRA AND CARACAS RAILWAY.—A RECLAMATION.

In our SUPPLEMENT of Nov. 21, 1885, we gave illustrations of some of the remarkable engineering works pertaining to the above railway, together with a few historical particulars of the origin and progress of the enterprise, which were derived, as there stated, from an English contemporary, *Engineering*. Probably by some inadvertence, the writer omitted to state that the originator and planner of the great work was an American citizen, Mr. John Houston, C.E., well known in engineering circles here, and specially distinguished for his success in mastering difficult situations. We give in another column a letter from Mr. Houston, in which he modestly rebukes the injustice done him by the omission of his name as the real author of the surveys, maps, and plans of the work; and we take pleasure in now rendering to him honor to whom honor is due. Mr. Houston is entitled to the highest credit for his services in laying the foundations for this extraordinary example of engineering.

THE TELEPHONE CONTROVERSY.

Among the most recent and ablest contributions to the literature of the telephone is an exhaustive article by Prof. Edwin J. Houston, of the Central High School, Philadelphia, contributed to the pages of the *Franklin Journal*. He presents with great clearness the invention of Reis, and in his favor as the prior inventor brings an overwhelming array of evidence.

A considerable number of illustrations are given, with descriptions fully explaining the nature of Reis' inventions and those of Bell, Blake, Berliner, and others. Many valuable particulars of the history, experiments with, and practical uses of Reis' telephones are given. The article closes with a series of letters from a number of scientific persons, residing in different parts of the country, in reply to a letter from Prof. Houston, asking them to say whether, in their opinion, Reis was the inventor of a practically operating speaking telephone, and if so, whether or not it worked substantially in the same manner as the Bell telephone. Some twenty responses are given, and the writers, without exception, testify in favor of Reis, and adverse to the pretensions of Bell. Among these witnesses are: Prof. C. A. Young, of Princeton College; Prof. Wm. A. Anthony, of Cornell University; Prof. Francis E. Nipher, of Washington University, St. Louis; Prof. A. E. Dolbear, of Tuft's College; Prof. Ogden N. Rood, of Columbia College, New York; Prof. C. F. Brackett, of Princeton; Prof. Charles F. Himes, of Dickinson College, Carlisle, Pa.; Charles M. Cresson, M.D., of Philadelphia; Prof. C. F. Van Dyck, New Brunswick, N. J.; Prof. C. Seiler, Philadelphia; Prof. W. L. Hooper, College Hill, Mass.; Prof. Geo. B. Merriman, Rutgers College, N. J.; Prof. H. C. Buck, Boston, Mass.; Prof. H. S. Carhart, Northwestern University, Evanston, Ill.; Prof. Charles K. Wead, University of Michigan; Prof. H. W. Wiley, Department of Agriculture, Washington; Prof. W. O. Semans, Ohio Wesleyan University, Delaware, O.; Prof. Charles S. Hastings, Yale College, New Haven, Conn.; Prof. John B. De Motte, De Pauw University, Greencastle, Ind.; Prof. Leonard Waldo, Yale College.

If the views of these intelligent examiners are correct, then the original decision of the United States court which awarded to Bell the honor of the discovery of the speaking telephone was an error, and the vast monopoly created under the broad claims of Bell's patent of 1876 is based upon a stupendous fraud.

A suit in the name of the people of the United States is now in progress by the Department of Justice, having for its special object to nullify the patent in case it is proved the claims were unjustly granted. The most strenuous efforts are being made by the supporters of the patent to arrest the progress of this suit; but the general public feeling is greatly in favor of having it pushed forward in the most vigorous manner. If the Bell people, as they claim, are the rightful owners of the exclusive art and apparatus of conveying speech by electricity, their claims will in this manner be settled and confirmed. If, on the other hand, their claims can be clearly proved to be invalid and wrong, then they should be promptly nullified, and the telephone made free to the people.

We publish in another column an interesting reply from the father of Prof. Bell, in answer to the letter we printed a few weeks ago from the distinguished Englih surgeon, Dr. Tait. The latter stated that Mr. Bell, Sr., and his son were both in Glasgow at the time Reis' telephone was exhibited there, and suggested that Prof. Bell, Jr., might have derived his original telephone knowledge from those exhibitions.

Prof. Bell, Sr., however, explicitly denies that he or his son Alexander ever saw the Reis telephone while in Glasgow, and his statement will be accepted as conclusive.

A recent number of the *Electrical Review*, London, contains a long letter from Prof. Alexander Graham Bell, addressed to Attorney-General Garland, in which he expresses the deepest indignation at the charges of fraud in various forms which he alleges are made against him by the Department of Justice in the documents pertaining to the suit before mentioned. Prof. Bell says, referring to his 1876 patent: "When I filed my application, I asserted that I was the first inventor of that art. I believed so then; I know so now."

In this letter Prof. Bell also pays his respects to Prof. Elisha Gray, and shows the allegation that he, Bell, derived information from Gray's caveat is without foundation. The men who have been active in fomenting the present suit are also shown up in this letter, and handled without gloves. We must say we sympathize with Prof. Bell, in view of the mass of stuff thrown at him by all the various parties, and all at once, as it were. We regret our space prevents us from publishing his letter in full.

One of the ablest newspaper articles on the telephone controversy is that recently contributed to the *Evening Post* by Mr. Frederic H. Betts, of the New York bar. We subjoin a portion only of his summary of facts:

"The controversy has turned upon the right of Bell to control the whole art of the electric transmission of speech *by means of his patent of* 1876. As bearing upon this latter proposition, the facts that we have above narrated are important, and they may be summarized as follows:

"1. Reis had described what he called a 'telephone' as early as 1861.

"2. With that instrument he had transmitted not only musical tones, but human speech, to the extent of individual words, at least, though not 'with a distinctness sufficient to every one.' He had also transmitted the inflections of the voice as in interrogation, exclamation, surprise, calling, etc. His instruments were capable, therefore, of reproducing to some extent the *quality* of sound as well as its *pitch*.

"3. Bell had never, up to the date of his patent, transmitted a single articulate word, or any '*quality*' of sound.

"4. In a statement made by him a few days before his application for the patent of 1876, he had admitted, expressly, that his instrument transmitted 'the varying *pitch* of the voice' only, but '*not* the *quality*.'

"5. The best that can now be done with the instruments described in the Bell patent is that, under exceptionally favorable circumstances, a few words can be intelligibly transmitted. This may be due in part to the increased cultivation of the ear since the practice of using telephones has been introduced.

"Mr. Watson, Professor Bell's assistant, has testified of experiments made at 40 State Street, in 1879, with reproductions of the original instruments:

"'The reason why the results were better, at 40 State Street, is in my opinion due to the fact that we were in a very quiet place, and that we were more practiced in listening for faint sounds than in 1875.'

"6. No such instruments as Bell described and illustrated in his patent of 1876 have ever been used for any practical or commercial purpose, without modifications of form and further patented improvement in material.

"It must also be added that Bell was not the first person to use, in a system of telegraphy, the undulatory current of electricity. A system of telegraphy founded upon the use of an undulatory as distinguished from intermittent or pulsatory current is described in the patent of Thomas A. Edison dated August 12, 1873, No. 141,177."

Protection of American Birds.

The annually increasing destruction of American birds for purposes of fashion, and the consequent startling decrease in the numbers of many of the choice varieties, have aroused the American Ornithologists' Union to form a Committee on the Protection of North American Birds. The secretary, Mr. E. P. Bicknell, announces the objects of the committee to be the gathering of all possible information on the subject of the destruction of birds and the steps necessary for their preservation in future; the diffusion of this information among the people in order to create a sentiment in favor of the birds, the formation of bird associations and other protective measures, and in time the framing of a suitable statute, for enactment in the several States and Territories, which shall give the same protection to the smaller birds that the game laws afford the larger.

Most people do object, in an abstract sort of way, to the wholesale slaughter of these pleasing little visitors for either sport or bonnets, and they do deplore the cruelty of nest robbing, but the committee realizes the fact that unless this sympathy takes a more active form, there will shortly be nothing to lament, for the birds will all be gone. Prompted either by their usefulness in checking the increase of insects harmful to vegetation, or simply by their cheery presence, we certainly owe these little songsters a friendly protection. A very pretty little sermon on the preservation of these feathered friends will be found in "The Birds of Killingworth," told by Longfellow in his "Tales of a Wayside Inn." The secretary of the committee invites communications and information from any people interested in its objects. His headquarters are at the Museum of Natural History, Central Park, New York.

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PHOTOGRAPHIC NOTES.

Method of Purifying Gelatine for Emulsions.—Mr. Alexander L. Henderson recommends that the dry gelatine be soaked for one hour in a solution of:

Water	20 ounces.
Acetic acid	1 ounce.

Then it is well washed to free it from the acid and other impurities, and finally spread out on *clean* cotton cloth to dry. Mr. Henderson advises that it is only necessary to treat the gelatine intended for emulsification as above. The bulk used to give body to the emulsion will be clean enough without the use of the acid. Respecting the flowing or coating of plates, he believes the sooner they are coated after the glass is warm and ready, the better the emulsion will flow.

Removing Lead Pencil Marks from Photographs.—We recently had occasion to mount in an album, on cardboard, several albumen photographs, many of which had lead pencil writing on the back; after they were dried and finished, we were surprised to notice the apparent disfigurement of some of the pictures by the appearance of the writing on the surface, reversed, precisely as if it had penetrated through the albumen film from the back. We very soon ascertained the cause and remedy. Before mounting the prints they were dampened and laid in a pile, the back of one resting upon the face of the other. The dampened albumen surface of the print, because of its sticky, gelatinous nature, took off the loose particles of graphite contained in the lead pencil writing on the back of the print above it, producing on its surface a reversed facsimile which was remarkably perfect and deceptive.

When the cause was thus found, the writing was at once quickly and easily removed by the use of the ordinary rubber eraser.

Inland Water Transportation.

There has been of late a great deal of discussion in committee rooms, in lobbies, and in the public press as to how far water transportation can compete with railroads. This discussion has been mainly limited to the consideration of our present canal system. The Erie, being the most important canal in the country, has been the subject of special investigation, and particularly when the proposition for making it a ship canal was being strongly urged. An examination of the relative merits of canal and railway transportation, as illustrated in the case of the Erie, shows, however, that in addition to its want of speed and the inconvenience arising from the winter's deadlock, the canal, all things considered, is the more expensive carrier. It may be asked, then, Why was it that the canal in one season delivered 37,500,000 bushels of grain at the port of New York, while the combined railroads during the same period brought only 28,000,000 bushels? The question is not difficult to answer, for with the State as the owner, it was undoubtedly cheaper for the shipper to send his grain by water than by rail, or there would never have been such a large tonnage on the canal. This argues well for the continued usefulness of the canal, since it is already in existence and the cost of its construction is not recoverable. But it certainly does not argue anything for the extension of the system. The actual figures show that were interest, maintenance, and repairs to be added to the cost of navigation, the railway would absolutely be the cheaper carrier. And no one has ever seriously questioned the relative advantages of the two methods aside from economy. Such is the testimony of the Erie Canal. We bring it forward again, because there is another system of water transportation of which we wish to speak, that offers very different results, and is now receiving increasing attention, but which, unfortunately, is being classed with canals and consequently invested with their imaginary merits by those in favor of that system, or with their faults by those opposed to it.

The drainage of a country by the operation of natural laws provides a series of water courses whose repeated unions finally furnish us with navigable streams. The advantages of the transportation facilities thus afforded are unquestionable. Not only is there no cost of maintenance or repairs, no interest on a large first outlay, and no restriction to an unlimited competition among the carriers, but in addition a water highway of this character permits a reasonable speed, and acts undoubtedly as a check upon excessive railway rates. In the transportation of goods, the river is certainly a successful competitor with the railway. But there are in addition to these recognized highways plenty of streams where the volume of water is sufficient, where the tributary country is highly productive, where perhaps no competing railway is in operation, but which are not navigable by reason of some natural obstruction, a ledge of rock, a shoal, a series of rapids, or something of that sort. The necessary intervention of the engineer, before such streams can be utilized, has in the minds of many people dragged them into the same classification as the canal. But there is nevertheless so large a difference between them that to us the one is desirable and the other is not. But, however the two systems may be regarded, the decision required is how far the margin in favor of river transportation will warrant an expenditure for rendering such a deficient stream available for navigation. There is a great temptation, in view of the history of cities the world over, to encroach upon this margin to its very limits, for the value of water facilities often means the difference between an unimportant town and a busy industrial center. In referring to this point, Major King, of the government engineers, calls attention to the fact that there is but one city in the United States of over 60,000 inhabitants which is devoid of water communication. He cites Springfield, Ill., Indianapolis, Ind., Columbus, Ohio, and Harrisburg, Pa., as four inland capitals which lack the vigor of full growth for want of water, while Chicago, Louisville, Cincinnati, and Pittsburg, possessing this element, flourish in a most gratifying manner. The cities, however, are hardly comparable, for the presence of legislators is generally believed to have a depressing effect upon industry. Otherwise the point is well taken. In the race for commercial supremacy the city possessed of water transportation will invariably take the lead, and it is a strong argument in favor of improving the rivers all over the country wherever possible. Major King, however, argues with equal enthusiasm for the extension of the canal system, and, like the people we have been talking about, puts both improvements into the same class. Yet one of those cities (Harrisburg) which he represents as languishing for lack of water has canal connection with the seaboard. If such water facility was all that was wanting, we should hear of her as another rival to New York, like her sister city in Illinois. But it is, as we have said, a very different case between improved natural waterways and such a purely artificial channel as a canal. If an already existing stream can be improved with advantage and be made economically available for commerce, it must be possible to accomplish the work with reasonable expense, to maintain it at a correspondingly limited outlay, and to assure one's self that when completed it will have some degree of permanence. Should it so far resemble the canal as not to be able to compete economically with land carriage, it is certainly not to be encouraged either as a national, State, or individual enterprise. There are many localities where a river could be rendered permanently—we use the term in its historical, and not in its geological, significance—open to navigation, and in such cases even a very large expenditure would be justified by the end in view. Remembering always the exact relation which the expense bears to the results effected, as well as how the work compares with the economical returns of land carriage, and there is no purpose to which the surplus revenues of a great country can be put with such lasting advantage as when judiciously expended in a systematic series of internal improvements.

Effect of Temperature upon Fishes.

A curious phenomenon is reported from Smyrna, Florida, as occurring during the recent cold wave which destroyed mangroves and oranges to an almost unprecedented extent. People are said to have picked up quantities of fish that were either dead or so stupefied by the cold as to float helplessly. It would be interesting to know whether these fish were really dead or only lying in a state of torpor. However this may be, the occurrence suggests some inquiries upon the effect of temperature upon fishes in their native element.

A little reflection leads to the conclusion that, although the changes in the temperature of large bodies of water are never so rapid or so wide in their range as the changes of the temperature in the air over them, the effect of such changes in abstracting heat from or imparting heat to living or inanimate bodies must be far greater in water than in air.

The specific heat of air is only 0·238 that of water, and a pint of water weighs nearly as much as 13 cubic feet of air at ordinary density. Hence a change of one degree in the temperature of a pint of water represents as great an actual heat change as a change of one degree in about 55 cubic feet of air. Both bodies impart heat by contact in the same manner, but by the immensely larger volume capacity of water for heat than that possessed by air, the effect of contact is very much more intense for a given difference of temperature with water than with air. Men or animals can pass from air at a temperature of 90° Fah. into a body of air even below the freezing point and remain for short periods without feeling even discomfort. This is done almost hourly in large breweries employing powerful refrigerating apparatus, and in large meat refrigerating establishments, wherein the temperature is maintained below 40° Fah.; and the writer has often, without even a coat, passed from a temperature of over 80° Fah. into a room where water was rapidly freezing, and the temperature was not more than 16° Fah. It is highly probable that to enter water at 32° from a temperature of 80° or 90° would either produce death or serious disorder to most kinds of warm-blooded animals. The shock is quite severe, in very warm weather, from a plunge into water at 60°. A gradual change would, of course, be less severely felt, but a plunge from air at 20° Fah. into water at 32° Fah. by a person having on the ordinary clothing, and, for that reason, having the surface of the body not colder than about 50° Fah., would be more than any weak constitution could sustain without serious injury, or even danger.

Changes in the temperature of water in large masses, resulting from changes in the temperature of the atmosphere, are, from the nature of the two substances, very gradual, no matter how violent the atmospheric change. It seems, then, somewhat remarkable that during the cold experienced in Florida fishes should be killed. It is, however, to be remembered that these fishes are living substantially in tropical waters, and that ice formed during the cold wave in small bodies of water, an inch in thickness. The temperature of the water from which the fishes were picked up must, therefore, have approached quite closely the freezing point; and there are many tropical fishes and marine animals that would soon die when exposed to such a temperature.

American Bridges Abroad.

The Union Bridge Company, of New York, has been awarded the contract for constructing a bridge across the Hawksberry River, in New South Wales. It is to be a double track railway bridge, consisting of seven steel trusses, 415 feet long, resting upon stone piers. The river at the proposed site for the bridge is practically an arm of the sea, having a tidal current which averages four miles an hour. The work will be unique in one respect, for the piers will have to go to the unprecedented depth of 170 feet below the low water mark. The foundations will be of beton inclosed in iron caissons. The depth and current will make the work one of great difficulty. The contract is with the Government of New South Wales, and calls for the completion of the work in two years and a half. Including the approaches, the bridge will be about a mile in length, and will cost probably something between one and a half and two million dollars.

When the work was contemplated, a commission of three noted English engineers was appointed to prepare specifications and invite bids. Their own estimate of the cost was three million dollars. Sixteen bids were submitted. They came from English, Scotch, French, German, Flemish, Australian, and American engineers. Fourteen of these bids were rejected by the commission. The two forwarded to the Government of New South Wales came from American firms, the Union Bridge Company and the Edge Moor Iron Company, of Wilmington, Del. These were the only American companies who entered the competition. Though the bid of the former was $150,000 the higher, their plan was accepted as being more feasible. It is understood that the stonework has been sublet to Anderson & Barr, of New York. The steel work will all be made at the company's establishment in Buffalo, N. Y. It is very gratifying that American bridge builders, in spite of the higher rates of wages prevalent in this country, are able to compete successfully with the older European firms. It is a large compliment to American engineers that such an important work should be intrusted to them in preference to home constructors.

The American Institute of Mining Engineers.

The forty-fourth meeting of the American Institute of Mining Engineers was held last week at Pittsburg, Pa. At the opening session, on Tuesday evening, the retiring president, Mr. James C. Bayles, delivered an excellent address on the subject of Professional Ethics. He spoke particularly of the dangerous sophistry which leads the young engineer into a questionable line of conduct, and makes his subsequent moral disintegration inevitable. During the several sessions of the Institute, a number of interesting papers on general scientific and professional subjects were presented and discussed. The chief interest of the meeting, however, was reserved for Natural Gas and the Clapp-Griffiths Steel Process. On Wednesday, a special train permitted the membess to visit the Plate Glass Works at Creighton, the gas wells at Tarentum, and a number of steel and glass works within the city limits. On Friday, a second excursion allowed the inspection of the Duncan Glass Works, the Clapp-Griffiths Converters, Jones & Laughlin's Mill, and the magnificent plant of the Edgar Thompson Steel Works. The summer meeting of the Institute wil be held at Salt Lake City.

A Cheap Ice House.

A box stall in the corner of Stephen H. Merritt's barn, in Dutchess Co., N. Y., serves for an ice house. The ice slides in at the window easily, and is taken out by a door in the feeding alley in the summer. A foot of sawdust upon loose boards and sticks provides drainage. The ice is also surrounded by eight inches of sawdust on the sides, and a foot on top. He says he has all he needs for dairy and other uses.

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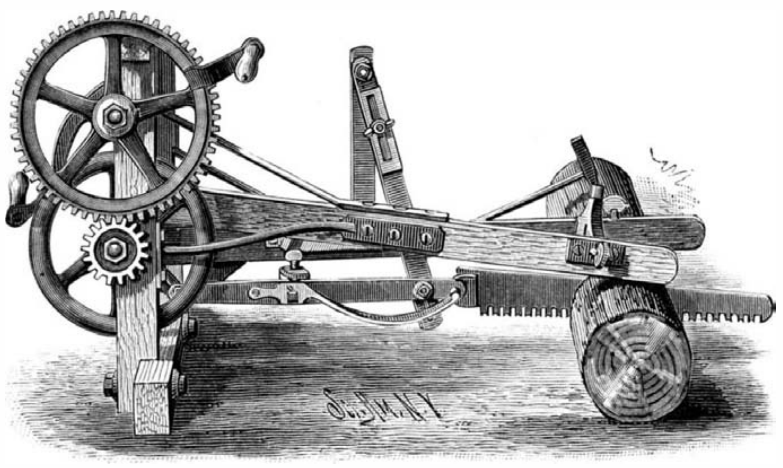
WOOD SAWING MACHINE.

The engraving illustrates a wood sawing machine, to be operated by one or two powers. The driving shaft is journaled in an upright frame, and has at one end a crank and at the other end a cogwheel having a crank handle. This wheel engages with a pinion on the end of a shaft carrying a flywheel, and formed at its opposite end with a crank which is connected by a pitman with the butt-end of the saw. The pin at the outer end of the pitman passes through a hole in the lower end of a lever pivoted at its upper end on a standard. This lever is composed of two longitudinally slotted overlapping pieces, so that by lengthening or shortening it the saw can be raised or lowered, according to the diameter of the piece to be sawed. The side bars of the frame are united at their front ends by a crosspiece, which is suitably slotted to receive the saw blade. Through the end of one of the side bars passes a screw, by means of which the bars are held to the log, and one or more clamping dogs are provided to hold the ends of the bars in place.

The lever being properly adjusted, and the screw and dogs being placed in position, the saw is rapidly reciprocated by turning the driving shaft. A spring attached to the butt of the saw and center of the pitman presses the teeth down upon the bottom of the kerf; this pressure can be easily adjusted. The blade is raised after having cut through the log, and is held in the guiding slot by a screw, so as not to interfere with shifting the machine.

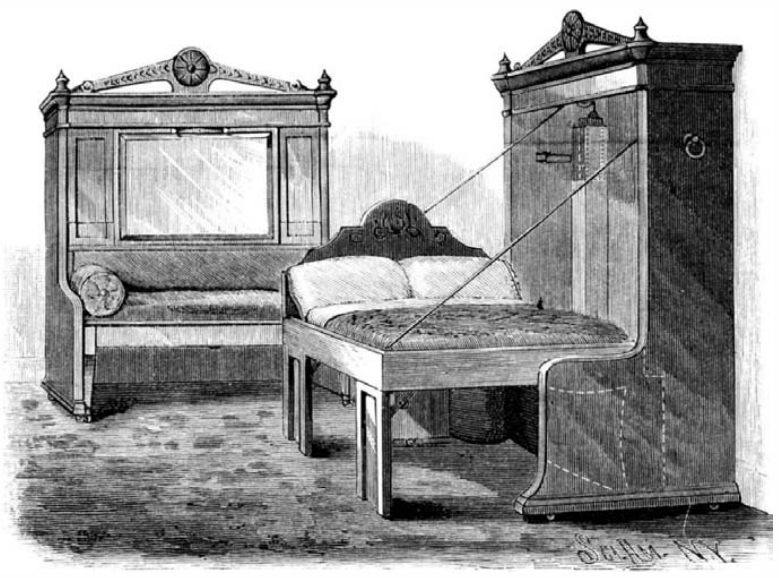
This invention has been patented by Mr. Samuel P. Dresser, of Pleasant Mount, Mo.



DRESSER'S WOOD SAWING MACHINE.

AN IMPROVED FOLDING BED.

The illustration herewith gives a good idea of a new form of folding bed, which, when not in use as a bed, can be folded up to form a sofa or lounge, surmounted by a mirror, in such way as to make a highly ornamental piece of furniture. The bed bottom is of such size that when it is swung up it fits in the opening in the front of the case, a mirror or fancy panel coming into place from the under side of the bed bottom, the legs being fitted to fold in recesses, and a part of the under side of the bed bottom being properly upholstered and arranged to come in place as a sofa back. A cord or chain, attached to the bed bottom frame, passes over a pulley on the inner side of the case at the top, to the end of which is secured a counterbalance weight, about equal to the weight of the bed and its attachments, to facilitate the easy folding and opening of the bed, the legs, when swinging into their places, being stiffened by braces which fall into position, the change from one use to another being easily and rapidly made.



DELL'S FOLDING BED.

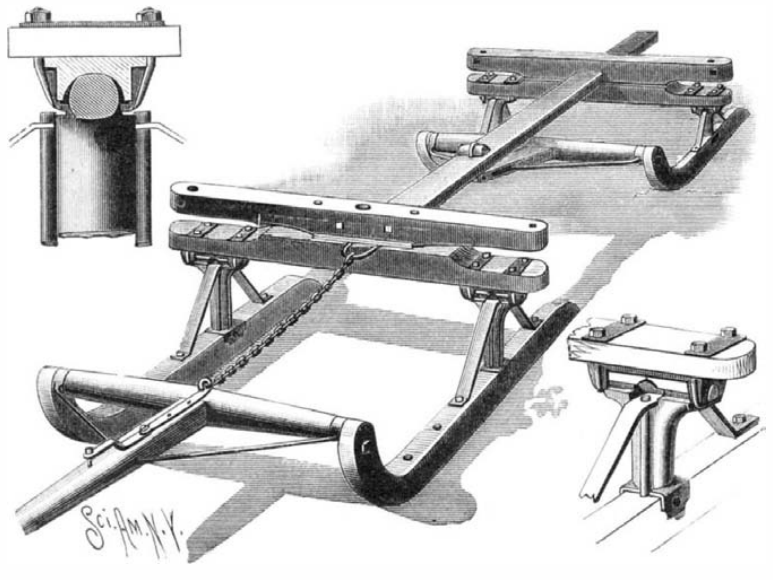
This invention has been patented by Mr. William H. Dell, of 211 E. 83d Street, New York city.

AN IMPROVED BOB-SLEIGH.

The construction herewith shown indicates a manner of building bob-sleighs whereby the knees will form double-acting connections between the runners and beams, and will thus allow the sleighs to work easily, while making a firm, substantial, and durable support for the beams. It is also calculated to keep the front beam always in an upright position, and make the draught of the rear bob come directly upon the tongue, allowing the reach to be used with a loose coupling.

The standards, or knees, have rounded transverse arms on their upper ends, with a longitudinal recess, the arms tapering down slightly from the recess, into which fits a cap having a projection from its under side, and concavities tapering from opposite sides of the projection receive the upper rounded and tapered surfaces of the arms, whereby a rocking and a lateral movement is afforded. The rave bolts extend upward from the runners in front and rear of the knees, and the raves rest between their ends on the bottom of the recess, an idea of the arrangement of these parts being presented in the two smaller figures, while the larger view shows a bob-sleigh in perspective, with these improvements applied. The beam is thereby prevented from oscillating, and yet the runners, through their oscillating connections, are allowed all desired freedom of movement, while the load is held level.

This invention has been patented by Messrs. Henry D. Jeffrey and Jacob Liver. Particulars can be had by addressing Messrs. C. A. Bierce & Co., of Winona, Minn.



JEFFREY & LIVER'S BOB-SLEIGH.

Unseasonable Pest.

The city of Mexico, for a number of months past, has been afflicted with a scourge of mosquitoes. These insects have prevailed to such an extent that they have been a constant theme of discussion, and have, in a number of instances, caused sickness, and, it is said, even death, by their poisonous bites. Official bulletins have been issued by the director of statistics, Dr. Penafiel, as to their habits, natural history, etc. Singularly, says *Science*, the species, which is a large one, has not been known, or has not attracted attention, before the past year; and fears are entertained that the pest is of recent introduction. The varying abundance of different kinds of insects during different years renders such a view improbable; yet it is significant that the present species is new to science, never having been described by entomologists.

AN exchange gives the following very simple way of avoiding the disagreeable smoke and gas which always pours into the room when a fire is lit in a stove, heater, or fireplace on a damp day. Put in the wood and coal as usual, but before lighting them, ignite a handful of paper or shavings placed on top of the coal. This produces a current of hot air in the chimney, which draws up the smoke and gas at once.

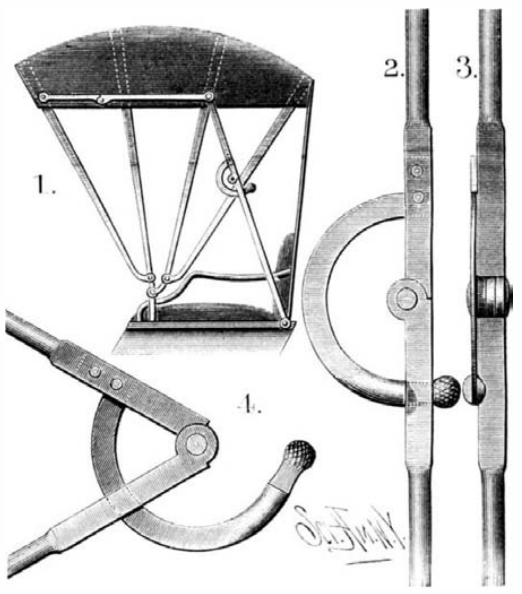
Bathing in Warm Water.

The *Sanitary World* considers cleanliness not only essential to good health, but it is a mark of good breeding. The laborer, by the clinging of dust to his perspiring person, becomes a fit subject for the bath tub very frequently. Too frequent bathing is weakening. It may not be advisable to take a bath morning and evening, as some medical journals advise, but a good washing frequently enough to keep the person clean. Warm baths will often prevent the most virulent diseases. A person who may be in fear of having received infection of any kind should take a warm bath, suffer perspiration to ensue, and then rub dry. Dress warmly to guard against taking cold. If the system has imbibed any infectious matter, it will be removed by resorting to this process, if done before the infection has time to spread over the system; and even if some time has elapsed, the drenching perspiration that may be induced by hot water will be very certain to remove it.

In cases of congestion, bilious colic, inflammation, etc., there is no remedy more certain to give relief. In cases of obstinate constipation also, wonderful cures have been wrought. For sore throat, diphtheria, and inflammation of the lungs, a hot compress is one of the most potent remedies.

BUGGY TOP SUPPORT.

This support for the tops of buggies and other vehicles, which is the invention of Mr. James J. Finney, of Junction City, Texas, is a simple, effective, and durable device to be attached to the folding braces of the top to prevent accidental folding. It consists of a curved elastic plate fixed at one end to one section of the folding brace of the top, and having at its other end a shoulder which locks against the other section, thereby holding the brace sections stiffly in line with each other. The support has an extension at its shouldered end for a finger piece, which may be pressed to throw the shoulder back from the brace when the top is to be lowered. The support is shown in position in Fig. 1; the brace sections are extended in line in Figs. 2 and 3, and are partly folded in the last view.



FINNEY'S BUGGY TOP SUPPORT.

Damp Beds.

The *Lancet*, referring to the death of Mr. Mads, the well-known tenor, calls attention to the peril of sleeping in a damp bed. As a matter of fact, this peril is of the greatest, and it is almost ever-present. The experienced traveler rarely hazards the risk of sleeping between sheets, which are nearly sure to be damp, until they have been aired under his personal supervision at a fire in his bed room. If this be impracticable, he wraps his rug around him, or pulls out the sheets and sleeps between the blankets—a disagreeable but often prudent expedient. The direst mischief may result from the contact of an imperfectly heated body with sheets which retain moisture. The body heat is not sufficient to raise the temperature of the sheets to a safe point, and the result must be disastrous in the extreme if, as is sure to happen, the skin be cooled by contact with a surface colder than itself and steadily abstracting heat all the night through.

There is no excuse for the neglect of proper precaution to insure dry beds. Servants are never to be trusted in this matter, and the managers of hotels, even of the best description, are singularly careless in respect to it.

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A NITRO-GLYCERINE SHELL.

The various experiments that have been made during the past few years in throwing dynamite cartridges have been duly reported in these pages. A novel departure in this line of gunnery is the shell or projectile illustrated in the accompanying cuts, the principle of which is to fill the two compartments of the shell with chemicals which, in themselves, are harmless and non-explosive, and to manufacture an explosive compound—nitro-glycerine—by combining these ingredients during the flight of the projectile. This departure from all experiments that have been hitherto made is so great that this subject will doubtless be found of interest to our readers. During all preliminary handling of the shell these ingredients—the acids and glycerine—are kept separated from each other; but at the instant the shell begins its flight, they are brought together, and the chemical action takes place during the journey.

The shell is made in two parts, screwing together, as shown, and the interior is divided into an upper and lower compartment; the upper contains the nitric and sulphuric acids, and the lower the glycerine. The partition separating the compartments is formed with two diametrically opposite passageways, each of which is adapted to be closed by a conically shaped valve carried upon the outer end of a lever. The inner ends of the levers are united by a crosspiece formed with a central threaded hole, in which fits a screw on a spindle extending through the conical end of the shell.

Near the outer end of the spindle is a cap fitting in a recess in the top of the shell. Screwing upon the extremity of the spindle is a propeller, which can be removed when the shell is not to be used, thereby making it impossible to turn the spindle to open the valves. The rapid passage of the shell through the air turns this propeller, when the inner ends of the levers are moved toward the partition by the screw and the valves are opened, permitting the acids to flow into the compartment holding the glycerine. The position of the levers at this stage is shown by the dotted lines. The contents of the chamber are then thoroughly mixed by the stirrers secured to the lower part of the rapidly revolving spindle. When the propeller meets a sufficient resistance, the inner end of the spindle will be brought violently into contact with a suitable detonator located upon the base of the shell as shown.

It is the intention of the inventor of this shell—Mr. C. W. Hayes—to throw it from the heaviest guns, with the largest charges of powder, since it can be thrown with as much safety to guns and gunners as the ordinary solid shot. It is perfectly adapted for use in guns of any size, having either smooth or rifle bores, and in muzzle or breech loaders. There is nothing explosive within the shell until the ingredients are mixed, and no mingling of them is possible until after the shell has left the gun, when all danger from shock is passed.

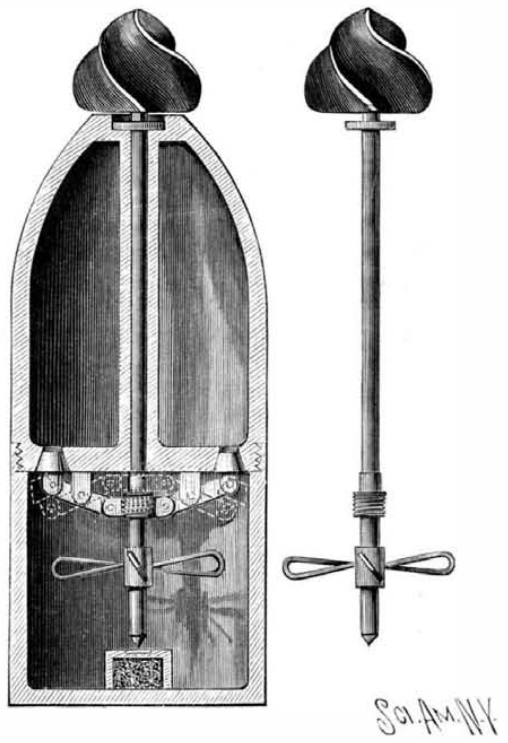
In regard to the speed to be attained by this shell, Passed Chief Engineer Rutherfurd, U. S. Navy, who has examined a working model, states that in his opinion the air resistance will be reduced ten per cent by the use of the propeller at the head of the shell.

This invention has been patented in the United States, Canada, and Europe. Mr. Michael Jacobs, of 335 Broadway, New York city, is the business manager, and by his courtesy we were shown the model from which the engraving was made.

MR. E. W. BRINE, of Fort Qu'Appelle, Canada, suggests, in reference to lighting the road while driving at night, that it is an excellent plan to attach the light to the pole of the wagon. In this position it is steadier, less in the horse's way, and furnishes better illumination than when secured to the horse's collar.

DISTRIBUTION OF ENERGY BY TRANSFORMERS.

One of the difficulties connected with the distribution of electric energy within a limited radius resides in the system of conductors. The loss in the latter, supposing, in order to simplify the problem, a perfect insulation of the wires, is proportional to the line's resistance and to the square of the intensity of the current traversing it. It is of interest, then, from the special point of view that occupies us, to make such resistance, as well as the current's intensity, as small as possible. But a diminution of the resistance leads to the selection of large and costly conductors; and a diminution of the intensity obliges us, in a distribution of some extent, to employ high electro-motive powers, that is to say, currents of high tension. Finally, these latter are not of easy application, especially when it is a question of distributing them to a certain number of consumers who desire to use them in a variable way, and independently of each other. Apparatus such as electric lamps, motors, etc., do not accommodate themselves to high tensions, and such tensions, on another hand, present some danger when they are introduced into the household and put at every moment within every one's reach.



HAYES' NITRO-GLYCERINE SHELL.

At first, electricians were content with distributions under low potentials (65 volts in the Gulcher system, and 100 in that of Edison), that permitted of the simultaneous use of the arc and incandescence lamps, small motors, etc., and of employing branched circuits within a limited radius around the central works. Since then the problem has expanded, and an endeavor is being made to extend the radius of distribution, without consenting to greater losses, by using high tensions for the general line, while at the same time reducing these dangerous potentials by means of transformers, so as to render the currents harmless and utilizable in ordinary apparatus.

A "transformer," in the general sense of the word, is an apparatus which, having received energy under a given form, modifies or transforms its qualities and restores it under the same form, but with different qualities. The Ruhmkorff coil in its ordinary form is the type of a transformer. It is furnished with energy by means of a pile or a machine, and restores electric energy that exhibits a much higher tension, but a much feebler intensity, than the tension and intensity of the current of the initial source. But the Ruhmkorff coil is capable of playing the opposite *role;* for, if we take this current of high tension and send it into the fine wire of a second bobbin, we shall receive in the circuit of the coarse wire of this latter bobbin a current that is much intenser, but that exhibits less tension, and is consequently capable, for example, of lighting a small incandescent lamp. It is a reverse transformation of the current, which has returned to its initial qualities after two successive modifications.

The properties of induction coils, which ought logically to be styled "transformers through induction," have been taken advantage of by different inventors for properly modifying the qualities of a current according to the application to be made of it. As long back as 1878, Mr. Jablochkoff employed them for supplying his kaolin incandescent lamps; but here the transformation so operated as to increase instead of to decrease the tension of the current. The inducting wire was traversed by alternating currents; the apparatus were mounted upon the terminals of the induced wire; and each bobbin supplied one kaolin lamp.

Fuller, in 1879, described, if he did not experiment with, a transforming apparatus of which the object was to have along the main electric circuit a large number of small lights, each placed in a local circuit in which induced currents were produced by the main circuit. Neither Jablochkoff nor Fuller gave rise to those ideas of distribution by transformers which are equally mentioned in the patents of Sir Charles Bright, and were produced anew in 1880 and 1881 by Messrs. Gravier & Cabanellas, when Messrs. Gaulard & Gibbs, taking up the question from a practical point of view, performed some experiments at London and Turin, in 1883 and 1884, by means of apparatus which they improperly called secondary generators. Finally, Messrs. Zipernowsky, Deri & Blathy after this brought out a system of distribution by transformers, and lighted up thereby the greater part of the National Exhibition at Budapest.

We shall now rapidly sketch the principal features of these two systems, bring into prominence the points that characterize them, and point out the special cases for which each is best adapted.

Messrs. Gaulard and Gibbs' transformers (Fig. 1) now appear in the form of vertical columns composed of

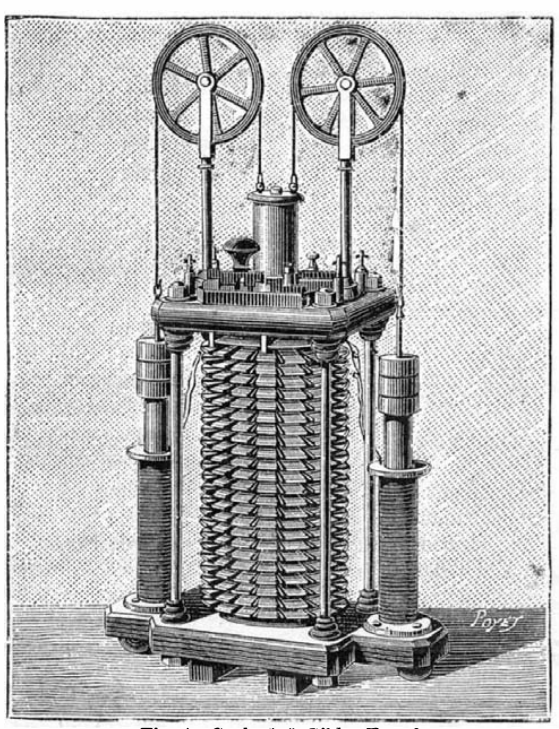


Fig. 1.—Gaulard & Gibbs Transformer.

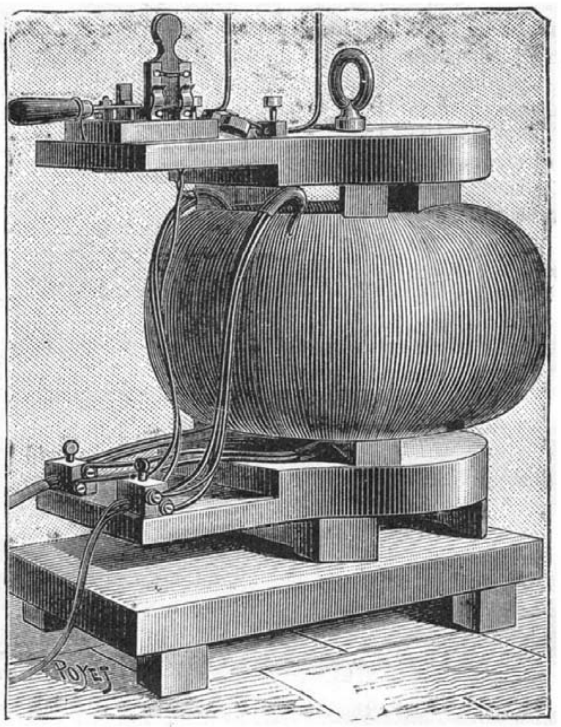


Fig. 2.—Zipernowski, Deri & Blathy's Transformer.

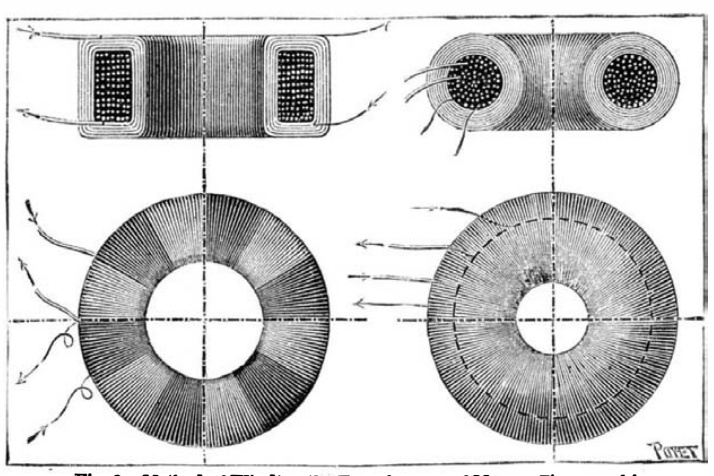


Fig. 3.—Method of Winding the Transformers of Messrs. Zipernowski, Deri & Blathy.

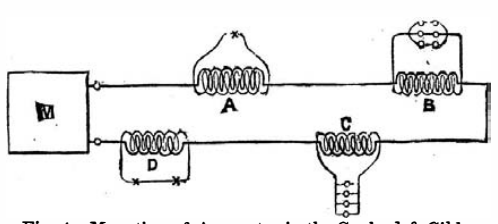


Fig. 4.—Mounting of Apparatus in the Gaulard & Gibbs System. I, constant. E, variable.

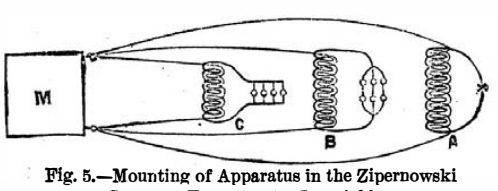


Fig. 5.—Mounting of Apparatus in the Zipernowski System. E, constant. I, variable.

DISTRIBUTION OF ENERGY BY TRANSFORMATION.

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thin copper disks, pierced in the center, split, and soldered together in such a way as to form two interlocking and independent spirals—a sort of double threaded screw, whose intervals are filled with parchment paper, so as to secure a perfect insulation between the two metallic circuits, one of which is the inducting and the other the induced. All the inducting circuits are mounted in tension (Fig. 4), and connected with the terminals of an alternating current dynamo machine. This latter is excited by a continuous current machine, which in turn is excited in a derived circuit. A rheostat maneuvered by hand, or by the current itself through automatically regulated apparatus, keeps the intensity constant in the line and inductors. In the induced circuit of each of these transformers, A, B, C, D, are mounted the various apparatus that are to be supplied.

The qualities of the induced currents are modified at will by properly connecting the disks that form the inducting and induced circuits. An electromotive force of greater or less strength is obtained by coupling a varying number of disks for tension, while, when, on the contrary, an intense current is needed, the induced disks form a series of short bobbins connected for quantity. When all the apparatus supplied by a transformer are lighted and extinguished together, the transformer is reduced to its essential elements—two series of disks and a soft iron core in the center. When the lamps are extinguished, the two extremities of the inducting circuit are connected by a short circuit, and nothing passes into the inducting one. Lighting is effected by opening the short circuit. The alternating currents then traverse the inducting circuit, and produce the proper alternating currents in the induced one.

Regulating is performed at the central works by varying the electromotive power of the generating machine in such a way as to keep the intensity constant, whatever be the number of transformers in service at each instant.

The arrangement is no longer quite as simple when the transformer is to supply a number of apparatus which is variable at will, since then the operation must be regulated in order to keep up a sensibly constant difference in energy at the terminals of the induced circuit. Fig. 1 shows one of the arrangements adopted by Mr. Gaulard for this purpose, and which is based upon the action of soft iron cores. Let us suppose, for example, as in the case of the apparatus, C (Fig. 4), a certain number of incandescent lamps mounted in derivation upon the induced circuit; then, when all the lamps are lighted, the transformer must produce its maximum, and the soft iron core (Fig. 1) is wholly within the bobbin. If the lamps be put out, the electromotive power of the apparatus will tend to increase, and an intenser current will then pass in the two solenoids, which are placed to the right and left of the transformer, and are mounted in derivation upon the terminals of the induced circuit These solenoids will more strongly attract the two soft iron cores, which, in descending, will, through the intermedium of two cords, lift the core of the transformer, put a portion of it outside of the action of the bobbins, and thus diminish the inductive action. It will be seen that the relative independence of the lamps supplied by one and the same transformer is purchased at the price of complications introduced into the apparatus itself. The performance of the transformer is variable with the number of apparatus supplied, and it diminishes in measure as we require less electric energy per unit of time in the main circuit.

Messrs. Zipernowsky, Deri & Blathy's transformers differ from the preceding in their mounting, their arrangements, and the results that may be obtained from them. They are mounted in derivation on the alternating current machine that supplies them (Fig. 5), and this must produce a constant difference of energy at the terminals, permitting of easier regulation.

An independence of the various apparatus is thus secured, and if one of them happens to be accidentally in short circuit, it will require but an automatic circuit-cutter to isolate it from the line without disturbing the operation of the other apparatus.

As the distribution is effected under a potential of 2,000 volts, it will be seen that it takes but a very weak current to disseminate considerable electric power, reducing the loss in the line to an insignificant figure.

These transformers have been variously arranged. Fig. 3 shows the principle upon which the most recent ones are constructed. Let us imagine a Gramme ring composed of a certain number of insulated bobbins, and let us connect all the bobbins of even series, in order to form an inducting circuit, and all those of uneven series to form an induced one. On connecting the inducting circuit with the terminals of an alternating current machine, the bobbins will be traversed by currents that are alternately of contrary direction, and that will develop in the core a magnetic field which will be closed, now in one direction and then in another. These alternating magnetizations of the core—these inverse fluxes of magnetic force, to speak according to the most modern ideas—will develop in the bobbins of uneven series induced currents, whose qualities may be modified at will by a suitable coupling. We shall thus have a transformer with closed magnetic circuit, in which each spiral, by reason of the symmetry, will exert identically the same actions, thus rendering the calculation of them much simpler. But this is not all; between very wide limits, from a current that is *nil* up to the one that is the maximum for which the apparatus has been constructed, the difference in potential energy at the terminals of the induced circuit remains constant, provided the difference at the terminals of the generating machine remains so too, and the intensity in the inducting current increases proportionally to the intensity in the supply circuit.

These valuable features permit this system to effect a distribution, that is to say, to vary the number of apparatus supplied each moment by a given transformer without touching the latter, this remaining inert and immutable. The regulating must be done at the central works.

In Fig. 3 will be seen another style of the transformer, which is nothing else than the Gramme ring reversed. The inducting and induced wires here take the place of the circular core of soft iron wire, and constitute two simple bobbins wound together with the number of revolutions and sizes of wire suited to the transformations to be effected. The wire of refined iron forms a sort of external annular core, and covers the inducting and induced bobbins.

Fig. 2 gives a general view of a transformer constructed as we have just described. The induced wire upon which the lamps are branched is coarser than the inducting one, since the role of the transformer is to reduce the initial potential of the line from 2,000 to 100 volts or less, while at the same time increasing the intensity in the supply circuit in an inverse ratio.

Without entering into a discussion of the respective merits of these apparatus, let us say that the arrangement of the one last described is better adapted for a true distribution, whatever be the dissemination of the lamps, since, without any regulating, we can at will vary the number of the apparatus supplied and secure an independence thereof. The Gaulard & Gibbs apparatus would be more specially indicated when we had a series of apparatus grouped in a certain number of centers easy to connect in a circle, and all operating together in each of these centers under the same circumstances and at the same moment.

Before the industrial use of these apparatus is sanctioned by practice, there are two questions remaining to be solved: Will the saving effected in the conductors compensate for the expense occasioned by the intermediate apparatus and the complications introduced by them? Will it be possible to easily and cheaply convert alternating currents into continuous ones in such a way as to satisfy all the exigencies of a truly complete distribution of electric energy? The results thus far obtained do not as yet allow us to answer yes or no, and it is necessary to wait for the lessons of experience before pronouncing.—*E. Hospitalier, in La Nature.*

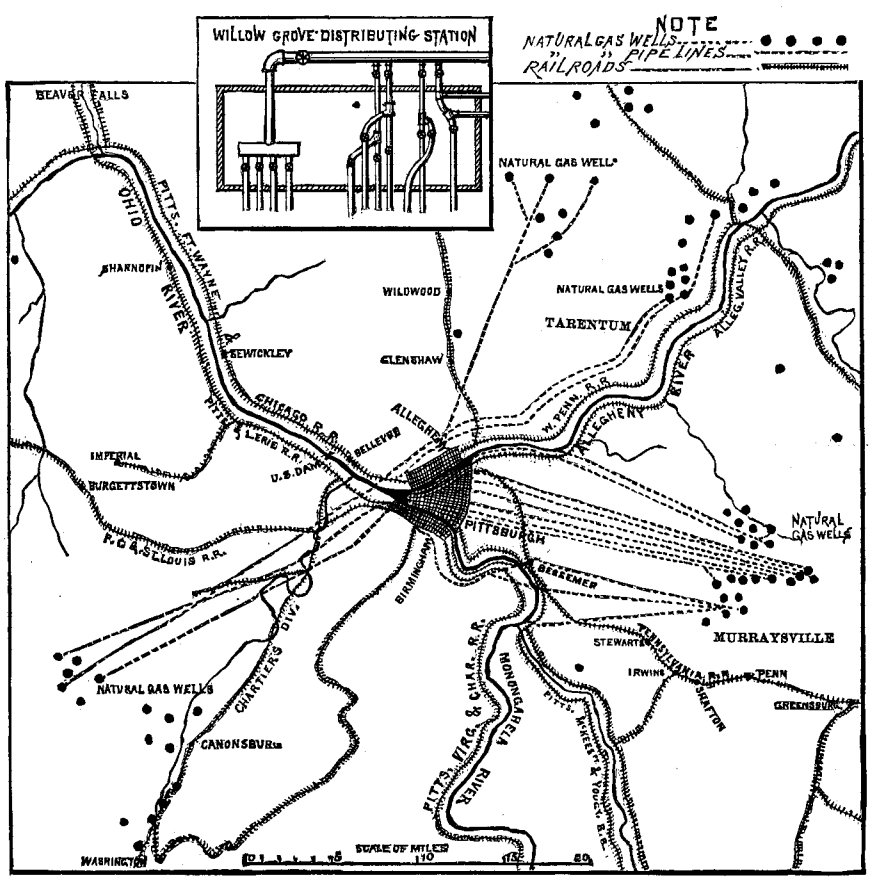
THE USE OF NATURAL GAS AT PITTSBURG.

(*Continued from first page.*)

of waves, the crests of which are known as anticlines, and the troughs as synclines. Many drillers suppose that the gas seeks the anticlines and the oil the synclines, but others, equally long-headed, discard entirely all theory of this kind, and drill wherever it may be most convenient or where other operators have already demonstrated the existence of gas. It will surprise many of our readers to know that the divining rod, that superstitious relic of the middle ages, is still frequently called upon to relieve the operator of the trouble of a rational decision.

The site having been selected, the ordinary oil-drilling outfit is employed to sink a hole of about six inches in diameter until the gas is reached. In the neighborhood of Pittsburg, this is usually found at a depth of 1,300 to 1,500 feet, in what is known as the Third Oil Sand, a sandstone of the Devonian period. Where the gas comes from originally is an open question. When the driller strikes gas, he is not left in any doubt of the event, for if the well be one of any strength, the gas manifests itself by sending the drill and its attachments into the air, often to a height of a hundred feet or more.

The most prolific wells are appropriately called "roarers." During the progress of the drilling, the well is lined with iron piping. Occasionally this is also blown out, but as a rule the gas satisfies itself with ejecting the drill. When the first rush of gas has thrown everything movable out of its way, the workmen can approach, and chain the giant to his work. The plant at the well is much simpler than one would suppose. An elbow joint connects the projecting end of the well piping with a pipe leading to a strong sheet-iron tank. This collects the salt water brought up with the gas. Ordinarily, about half a barrel accumulates in twenty-four hours. A safety valve, a pressure indicator, and a blow-off complete the outfit. When the pressure exceeds a prescribed limit, the valve opens, and the gas escapes into the blow-off. This is usually 30 feet high or more, and the gas issuing from the top is either ignited or permitted to escape into the atmosphere. The pipe line leading from the tank to the city is of course placed underground. Beyond a little wooden house, the blow-off, and a derrick, the gas farms differ little in appearance from those producing less valuable crops.



The pressure of the gas at the wells varies considerably. It is generally between 100 and 325 pounds. As much as 750 pounds per square inch has been measured, and in many cases the actual pressure is even greater than this, but, as a rule, it is not permitted to much exceed 20 atmospheres in any receiver or pipe. The maximum pressure in the lines of the Philadelphia Company is 340 pounds. The supply of Pittsburg is largely in the hands of this organization, and drawn from its wells at Tarentum and Murraysville. A number of other companies are also in the field, but the chief business of the city is still controlled by the Philadelphia. The question of pipeage is one of immense importance, and, with increased knowledge of the best conditions for securing an even flow of gas, becomes even more prominent, for the lines are being rapidly extended in length, and it is asserted by many practical gas men that they will some day reach the seaboard.

The pipe lines of the Philadelphia Company vary in diameter from 4 to 10 inches. The Chartiers Company, however, have one line of 16 inches in diameter. In the city, the distributing mains are from 4 to 24 inches. The general tendency is to an increase of diameter, in order to lessen the friction and enable the supply to meet any unexpected demand without interfering with the usual flow. The average diameter of the city mains may be stated at 16 inches. The distributing pipes vary from 4 to 10 inches. The pipe lines have to be laid with the greatest care, to withstand these high pressures and avoid leakage. They cost from $2,000 per mile for pipes of 4 to 8 inches up to $30,000 for 24 inches. The Philadelphia Company alone has about 375 miles of pipes 4 inches in diameter and over.

Every day, line walkers go over the entire line, and submit reports of its condition to the central office. Every leak, no matter how small, is included in the report. In addition to this daily inspection, a man is sent by the company to every fire, and it is his duty to turn off the gas from the burning building and from any that may be in immediate danger. The question of pressure throughout the lines is one of vital importance, and its regulation demands constant attention. For this purpose, valve houses, or stations, to the number of 22, have been established at various points on the line as well as in the city, and at Tarentum, Mur-

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raysville, and Dick Farm. At each of these stations the pressure is registered every hour. The company has four telephone lines of its own, of a total length of about 80 miles, and each station is connected with the central station on Penn Avenue. In this way the supply all over the city is closely watched.

Should it become deficient in any district—which would be indicated by a marked decrease in the pressure—it is but a moment's work to call up the central station, and have more gas turned into the needy district. An early disadvantage in using natural gas was it constant liability to failure, but this system of telephonically connected stations has done away with this, and created a confidence in the reliability of the supply. The arrangement of the pipeage and gates at these stations is shown in our diagram of the Willow Grove Station. Coming, as most of the gas does, a distance of twenty miles or so, its pressure is much reduced during the journey by friction against the sides of the pipes. It is contrary to law to maintain a pressure of more than 15 pounds within the city limits. Consequently, blow-offs are established at various points; and whenever the pressure exceeds 10 pounds, the safety valve opens, and the gas escapes.

This leaves a margin of five pounds, but in some of the older and smaller pipes the pressure does sometimes exceed 15 pounds, as a heavier force is needed to overcome the increased friction.

During the day, when the mills are running at full force, the pressure in the city mains is from 2 to 5 pounds; but at night, and more particularly on Sundays, the pressure becomes greater, and large volumes of gas escape at the top of the blow-offs. The one on the Allegheny River at the foot of 10th St., shown in our illustration, Fig. 1, as it appears on Sunday evening, is 40 feet high, and perforated at its upper end for a distance of 3 feet. The immense flame, 40 to 60 feet long, as it is blown about by the wind, has the appearance of a giant torch. To a stranger there are few sights more striking than that presented when he looks down from one of the surrounding hills, and sees the city at night illuminated by these lurid flames. The custom of keeping these torches lighted is not maintained, however, entirely for scenic effect, but in many cases is intended to avoid the noise of the escaping gas. At such a height, the gas would do no damage, if permitted simply to escape into the air. Having a specific gravity of only about half that of air, it is dispersed immediately into the upper regions of the atmosphere.

There are now few mills or furnaces in Pittsburg or the vicinity that are not using gas exclusively. At the Edgar Thompson Steel Works, at Braddocks, the gas is used in all departments where coal was formerly employed. The furnaces used for reheating the steel billets, that are afterward rolled into rails, are shown in Fig. 2, and will give some idea of the scale upon which this immense establishment has been built, and the importance which such a change of fuel means. If one has visited Pittsburg in the days of coal and smoke, he has only to go on the streets and notice the comparatively clear atmosphere and the clean faces to realize what a blessing natural gas has been, aside from its economic value. In the boiler room the change is no less marked. The bricks are neatly whitewashed, the ironwork painted, and the engineer sits in one corner of what might be a parlor as far as neatness goes, quietly watching a water gauge and indicators. The best arrangement for burning the gas under the boiler is that practiced by the Electric Light Company at their central station in Virgin Alley, shown in Fig. 3. The gas passes into a 4 inch drum extending in front of the boilers, and thence by a 1½ inch pipe into T-burners in the front of the firebox. These are simply perforated pipe, 2 inches in diameter.

The air for combustion is first heated before mixing with the gas. Sheet iron is placed upon the grate bars to within about 4 inches of the rear, and 2 inch tiles are placed between this and the boiler, leaving sufficient space in front for the flame to play over them. The air enters beneath, and passing along the under side of the tiles is heated before coming in contact with the gas. It is very important at such an establishment to be able to burn coal at very short notice, should any accident happen to the gas supply. As at present arranged, the entire change can be made and a coal fire started within eight minutes. The gas is burned under the boilers at a pressure of from three-fourths to one pound. As the pressure in the mains is considerably in excess of this, it must be reduced by an automatic regulator. In dwelling houses the gas is seldom burned under more than 2 to 6 ounces.

The regulator, Fig. 6, is a very important piece of apparatus, as it must be used in every mill or house where natural gas is burned, as well as in regulating the pressure where the mains enter the city limits. It is not understood, even by the majority of the people who use it; but if the reader will follow closely our description, he will at least be able to get a general idea of its action. The city inlet terminates in a small cast iron chamber, having two valves on opposite sides. These valves are on the same piston rod, and consequently, when this is moved, one opens toward the interior and the other toward the exterior of the chamber.

A second chamber is divided into two parts by a rubber diaphragm, the upper portion being in communication with the atmosphere, and the lower with a space surrounding the small chamber first mentioned. The diaphragm is weighted above, and below acts upon an elbow lever connected with the valve rod. It will be understood that the lever is in the chamber under the diaphragm, and that the valve rod operates in the inclosed space communicating with this chamber. Bearing this disposition of the apparatus in mind, when the gas enters the small chamber it opens the valves and passes through into the surrounding space and into the chamber under the diaphragm. As the house inlet opens from this inclosed space, the gas has now free access to the service pipes. But the gas raises the diaphragm, and through the lever closes the valves, shutting off the supply. As the gas is consumed the diaphragm sinks under its weights, and more gas is admitted. By altering the weights, the regulator may be set to deliver gas at any desired pressure less than that of the initial. Should the supply of gas be cut off, the regulator automatically locks itself, and will deliver no gas until locked by hand. This prevents the escape of gas, should it be put out by a temporary failure of the supply and then turned on again. As it is so largely composed of marsh gas, it forms, when mixed with air, an explosive compound similar to the deadly fire damp of the coal mines. Consequently, fire must be applied to the orifice before the gas is turned on, or else there will be an explosion. To avoid such a possibility, a small jet of gas is often allowed to burn all the time, in order to light the larger burner as soon as it is turned on. The new fuel is becoming extremely popular for domestic use. In grates, a flat perforated box, as shown in our engraving, Fig. 5, is commonly placed in the bottom, and covered with fragments of fire clay. In cook stoves, Fig. 4, T-burners are used, generally in pairs, though usually only one is lighted unless a large amount of hot water is wanted in the boilers. In round stoves, it is common to use simply the Bunsen burner without the box attachment. The price of gas is usually a matter of contract, based upon former coal bills or upon the mill product. In Allegheny City, however, it is sold at 10 cents per thousand feet, and at this rate may be a little more expensive than coal, but is used nevertheless on account of its great convenience. There have been a number of distressing accidents attending the use of the gas, but the total fatality, it is well to remember, is much less than that of a single mine disaster such as that at Nanticoke.

Microscopical Notes.

Cocaine for Killing Animalcules.—The action of the reagents in general use for killing animalcules for mounting disturbs the natural appearance and position of such delicate structures as the tentacles of hydroids and bryozoa. Prof. J. Richard has successfully employed in these cases the anæsthetic power of cocaine hydrochlorate. Several of the animalculesare placed in a watch glass with five cubic centimeters of water. When they are fully expanded, a one-half per cent solution of cocaine hydrochlorate is added drop by drop until it forms a fifth part of the entire fluid. Half a cubic centimeter of the anæsthetic is then added, and the animals become completely fixed. Ten minutes afterward they are quite dead, and can be mounted in the ordinary way.

Microscope, Microscopic, Microscopical.—The practice of even the most scholarly microscopists is not quite uniform in the employment of the words microscope (used adjectively), microscopic, and microscopical. Is it not desirable to make an effort to bring about uniformity? The usage which best commends itself to us is in accord with the following directions:

1. Apply "microscope" (the adjective) to the component or essential parts of the microscope, *e. g.*, microscope stand, microscope stage, microscope objective.

2. Restrict "microscopic" to objects or features too minute to be seen or appreciated by the naked eye.

3. Reserve "microscopical" for uses to which the term "microscopic," as above restricted, would be inappropriate, *e. g.*, microscopical society, microscopical accessories, microscopical science, works, observations, researches, themes, purposes, uses; microscopical examination.

As an epithet to the word "examination," microscopical is certainly preferable to microscopic, since the idea intended to be conveyed is of an action performed with the aid of the microscope, rather than of one too minute to be visible to the naked eye.

Among professional men an organized society of microscopists is now generally, if not universally, denominated a microscopical society. "Microscopic society" is sometimes heard, and, unfortunately, it sometimes gets into print. Its use ought to be actively discountenanced.—*Jour. N. Y. Microscop. Soc.*

White Resin as a Mounting Medium.—Mr. William Wales recommends white resin as a good medium for mounting. He says that it is easily soluble in alcohol, melts readily, cools quickly, and is more transparent than balsam. He has found it a better material than balsam for cementing lenses, and this he deems a good test. Mr. H. L. Brevoort indorses Mr. Wales' statement, and gives the following as his method of using the material:

On the center of the clean glass slide laid on the heating table, I put a small piece of resin of the purest quality. Heat is generally applied until the resin becomes as liquid as it can be made without burning it. To remove air bubbles, with a pointed glass rod I add to the liquefied resin, and stir in with it, a half drop of turpentine. A moment or two after the object to be mounted has been placed in the medium and the cover glass has been dropped upon it, the slide must be removed from the hot table and a spring clip applied. In five minutes the mount will be ready for finishing and labeling.

Cell Wall Markings.—Messrs. Lawrence and Raddin have been making a study of the markings of the cell walls of various exogenous trees, with the object of ascertaining whether it is possible to distinguish species by this means. The results of their studies are given in the *Microscope* for November.

The conclusion reached by them is that species cannot be distinguished by this means, and they further observe that the same species collected in different localities presented differences that were sometimes very great. They even assert that species of the same genus frequently bear no relation to each other in this respect, and that the markings on the cells of the red oak (*Quercus rubra*) sometimes so closely resemble those of the whiter pine (*Pinus strobus*) that there is danger of compounding the woods of these two trees.

A Method of Cleaning Stonework.

It is sometimes required to clean the surface of old masonry that has become weathered or coated by deposits from dirty water, either for the sake of appearance or to make a sound connection with new work. The only effectual method hitherto practiced for this purpose has been by completely redressing the surface with the chisel—a method which is tedious and costly at best, and which is seldom thoroughly carried out. A different and, it is claimed, more satisfactory process was devised by M. De Liebhabert, and used in 1884 for cleaning the walls of the quays of the Seine in Paris. These walls become in a few years covered with a shiny black deposit, which resists acids. To remove it, a paste composed of a solution of soda and lime, to which a little chloride of lime is added, was mixed to the consistency of honey, and spread over the surface, where it was allowed to remain for two or three hours, according to the condition of the stone. When it was removed, the deposit was still black; but it had become sensitive to acids. After this preliminary treatment, a workman passed over the surface (with a large gutta percha brush) a mixture called sulphochlorhydric, forming on the stone a kind of glue; and almost immediately afterward he syringed the surface with a jet of the same liquid. It formed an adherent paste, continuing to act upon the stone for about two or three hours. After the syringe came a gang of men who scrubbed the surface, finishing off with a hose pipe. The sulpho-chlorhydric mixture is composed of sulphuric and hydrochloric acids mixed empirically according to the nature of the stone and the necessities of the case. The cost of cleaning stone walls by this method in Paris is 0·46 franc per square meter for material and 0·50 franc for labor, by contract. The preliminary treatment by the caustic paste was paid for separately at 0·50 franc per square meter. It is said that the stone itself is not damaged by this treatment, and soon regains its natural color.

Fuel of the Future.

The house of the near future, the *Boston Journal of Commerce* thinks, will have no fireplace, steam pipes, chimneys, or flues. Wood, coal oil, and other forms of fuel are about to disappear altogether in places having factories. Gas has become so cheap that already it is supplanting fuels. A single jet fairly heats a small room in cold weather. A New York artist has produced a simple design for heating entirely by gas at a mere nominal expense. It is a well-known fact that gas throws off no smoke, soot, or dirt. The artist filled a brazier with chunks of colored glass, and placed several jets beneath. The glass soon became heated sufficiently to thoroughly warm a room 10x30 feet in size. This design does away with the necessity for chimneys, since there is no smoke; the ventilation may be had at the window. The heat may be raised or lowered by simply regulating the flow of gas. The colored glass gives all the appearance of fire; there are black pieces to represent coal, red chunks for flames, yellowish white glass for white heat, blue glass for blue flames, and hues for all the remaining colors of spectrum. Invention already is displacing the present fuels for furnaces and cooking ranges, and glass doing away with delay and such disagreeable objects as ashes, kindling wood, etc.

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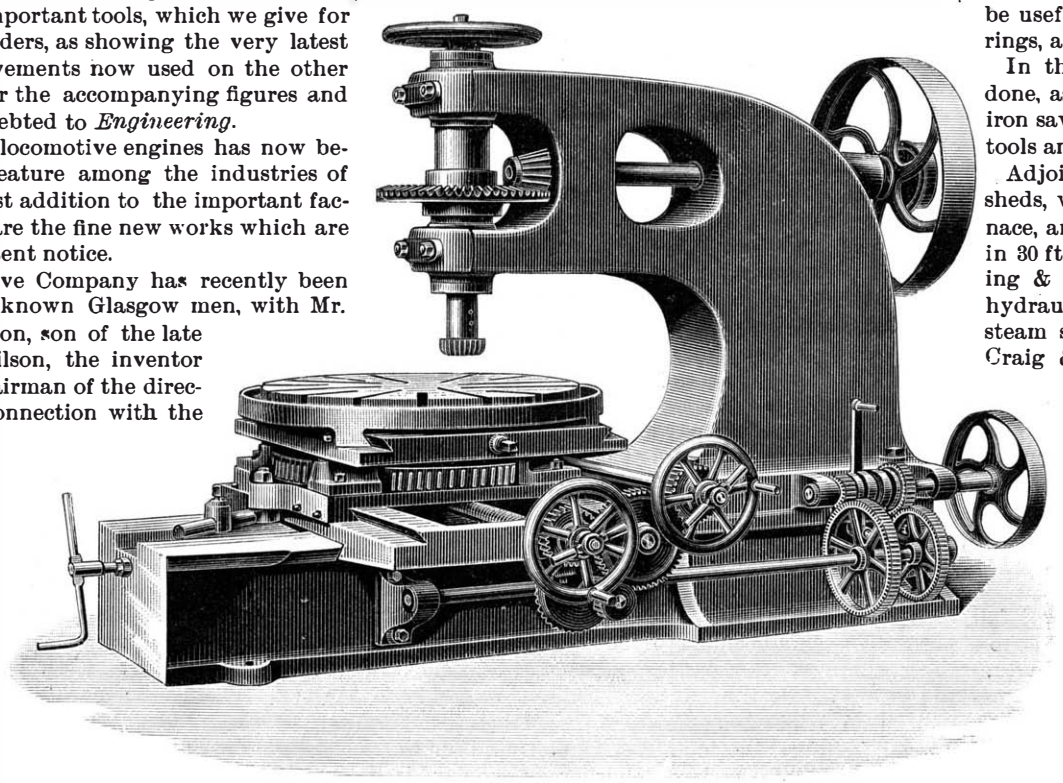
THE CLYDE LOCOMOTIVE WORKS.

In our last number we briefly alluded to this new establishment, lately put in operation in Glasgow, and gave an illustration of one of the large planing machines there used. We this week present additional engravings of other important tools, which we give for the information of readers, as showing the very latest styles and best improvements now used on the other side of the water. For the accompanying figures and particulars we are indebted to *Engineering*.

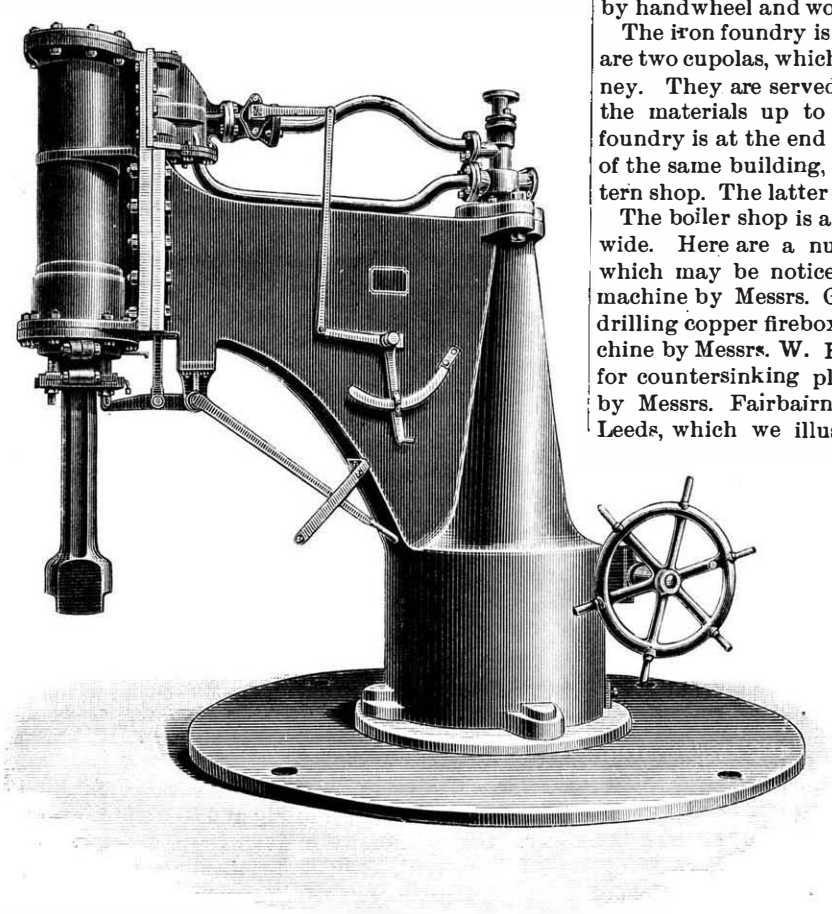
The manufacture of locomotive engines has now become a considerable feature among the industries of Glasgow, and the latest addition to the important factories there situated are the fine new works which are the subject of our present notice.

The Clyde Locomotive Company has recently been formed by a few well known Glasgow men, with Mr. W. Montgomerie Neilson, son of the late James Beaumont Neilson, the inventor of the hot blast, as chairman of the directors. Mr. Neilson's connection with the locomotive trade is well known, he now having been associated with the business for the last forty years.

The works we are about to describe have been laid out specially and solely with a view to making locomotive engines. They are absolutely new from end to end—new buildings, new plant, new machinery, and new tools. We believe there is not a machine or tool in the place that has ever been worked before; in fact, everything is new, except the experience which has directed the laying out of the works, and that is thoroughly matured.



IMPROVED MILLING MACHINE.



RADIAL STEAM HAMMER.

There are few who can have had more experience in the locomotive trade than Mr. Neilson, and that he has made good use of this experience need not be here insisted upon. He has been assisted in the work of laying out the shops by Mr. T. M. Grant, Mr. T. Fleming, and Mr. J. Webster, who have had considerable experience in this special branch of engineering construction, and who all hold important positions in the new works. Mr. Alexander Wilson will take charge of the commercial department. From what has been said, our readers will infer that these shops are likely to be examples of the best locomotive building works, embodying the whole range of experience up to the present day; and, indeed, such is the case, for neither money nor pains has been spared to render them perfect.

The works are situated on the North British Railway, adjacent to the Barnhill and Springburn stations. They at present cover fully ten acres, and are so designed that any department can be extended without interruption to the work. The forge and smithy is 182 ft. long and 131 ft. wide. In the center of the forge building there is a radial steam hammer of about 5 cwt., by Messrs. Davis & Primrose of Leith, of which we give a cut. In this machine the whole hammer, including the single overhanging standard, will turn on its axis, which is the center line of the standard, the steam and exhaust pipes coming in to this axis. This hammer is for dabbing on the spoke ends of wheels, the work being done in dies and the hammer swinging round to cover the work, instead of that having to be shifted. A second anvil will be placed so that the hammer can be used for any ordinary work. The swiveling is effected by handwheel and worm gearing.

The iron foundry is 144 ft. long by 40 ft. wide. There are two cupolas, which lead into one central brick chimney. They are served by a hydraulic hoist for taking the materials up to the charging level. The brass foundry is at the end of the iron foundry, and is part of the same building, and beyond this again is the pattern shop. The latter shop is 130 ft. long by 42 ft. wide.

The boiler shop is a building 162 ft. long and 150 ft. wide. Here are a number of machine tools, among which may be noticed a two-spindle vertical drilling machine by Messrs. G. & A. Harvey, of Glasgow, for drilling copper fireboxes, and a somewhat similar machine by Messrs. W. Robertson & Co., of Johnstone, for countersinking plates. Near this is a radial drill by Messrs. Fairbairn, Naylor, Macpherson & Co., of Leeds, which we illustrate. It has a Crow's patent table, which can be partially revolved by gear in both a vertical and a horizontal plane, and by a combination of the two, a diagonal rotary motion can be given. The table is mounted on trunnions, and is placed over a pit, so as to take work of considerable size. It will be useful for drilling domes, fireboxes, bottom joint rings, and other work of a similar nature.

In the north bay the engine tender work will be done, as well as boiler work. Here are hot and cold iron saws and several smiths' fires, with various other tools and appliances.

Adjoining the boiler shops are the plate flanging sheds, with two plate furnaces, one angle iron furnace, and one frame plate furnace, which will take in 30 ft. There is a hydraulic press by Messrs. Fielding & Platt, for firebox plates, served by a 3 ton hydraulic Bessemer crane. There is also a large steam shearing and punching machine, by Messrs. Craig & Donald, of Johnstone, and an angle iron bending machine by Messrs. Butterfield, of Keighley. Adjoining this shop is the building containing three Lancashire boilers with corrugated flues, by Messrs. Penman & Co., of Glasgow. They are 7 ft. 6 in. in diameter and 30 ft. long. A fourth is shortly to be added.

The principal building in the works contains the machine tool and fitting shops, the erecting shop, and the grindery. It is 268 ft. long and 202 ft. wide, and is divided into seven bays, the end one being partitioned off for the brass finishing and grinding departments.

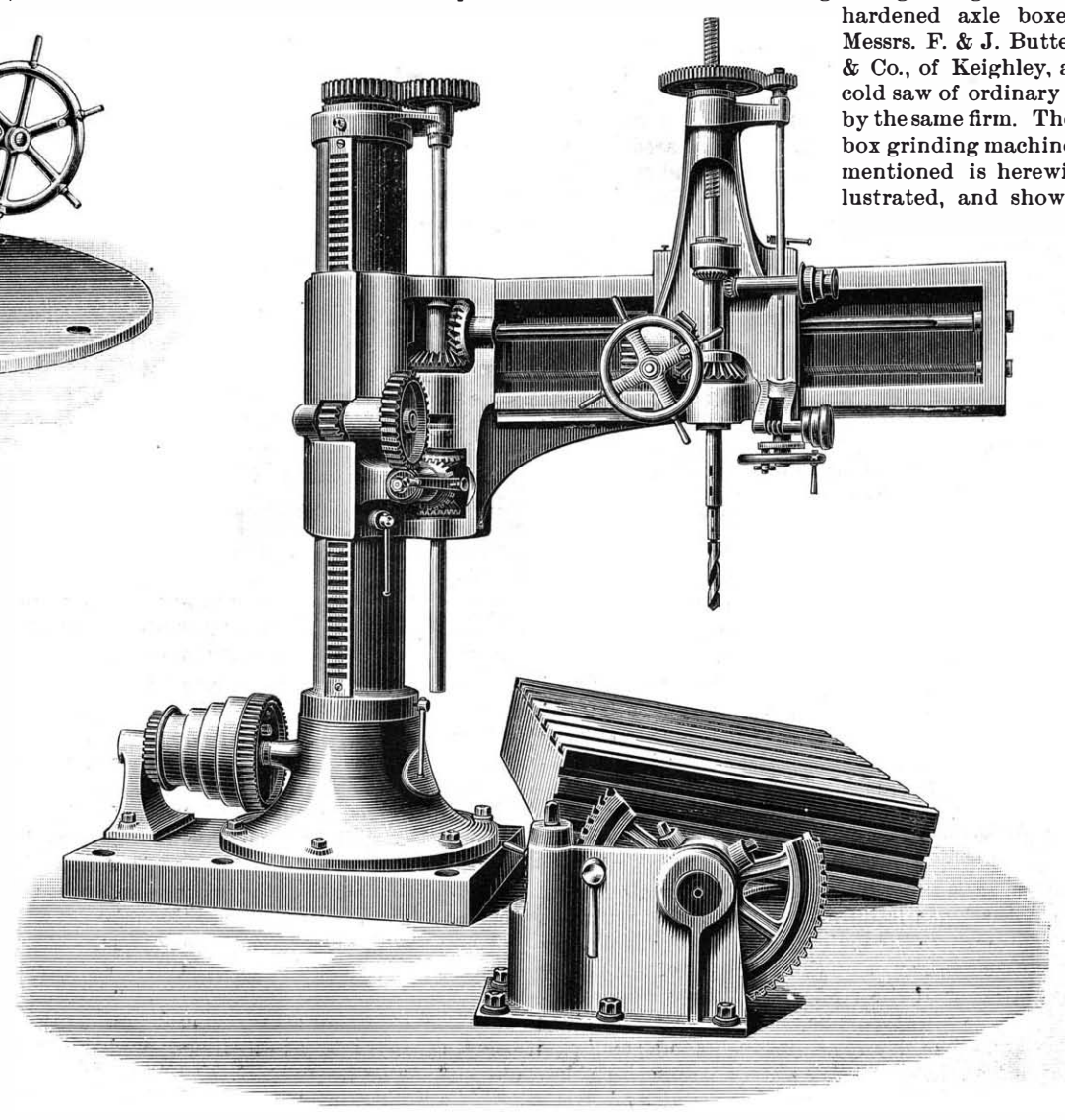
The remaining six bays are devoted to machine tools for the engine department and the erecting shop.

There is near here a large milling machine by Messrs. Craven Brothers, for milling bosses of wheels. It has a compound table fitted with circular and radial motions, the latter being a new feature.

There is a frame plate slotting machine by Messrs. Fairbairn, Naylor, Macpherson & Co., which will take in frames 36 feet long and 4 feet 6 inches wide. This machine, herewith illustrated, has three cross slides which can travel along the bed, and the slides can be swiveled on the standards for slotting diagonally across the frame. This motion is useful for cutting out the wedged-shaped pieces for taking up the wear of axle boxes. Next to this is placed a machine to be used for operating on the same sized frame plates, for drilling the necessary holes. This is by Shepherd, Hill & Co., of Leeds. It has three sliding overhanging headstocks with balanced spindles.

A machine which we think is quite a novelty has been designed for cutting off and centering axles. The spindles for the centering tools are carried in a headstock, which cross-traverses on a slide above the bed. The tool is by Messrs. G. & A. Harvey, of Glasgow.

There is a machine for grinding wrought iron case-hardened axle boxes by Messrs. F. & J. Butterfield & Co., of Keighley, and a cold saw of ordinary make by the same firm. The axle box grinding machine just mentioned is herewith illustrated, and shows the



IMPROVED RADIAL DRILLING MACHINE.

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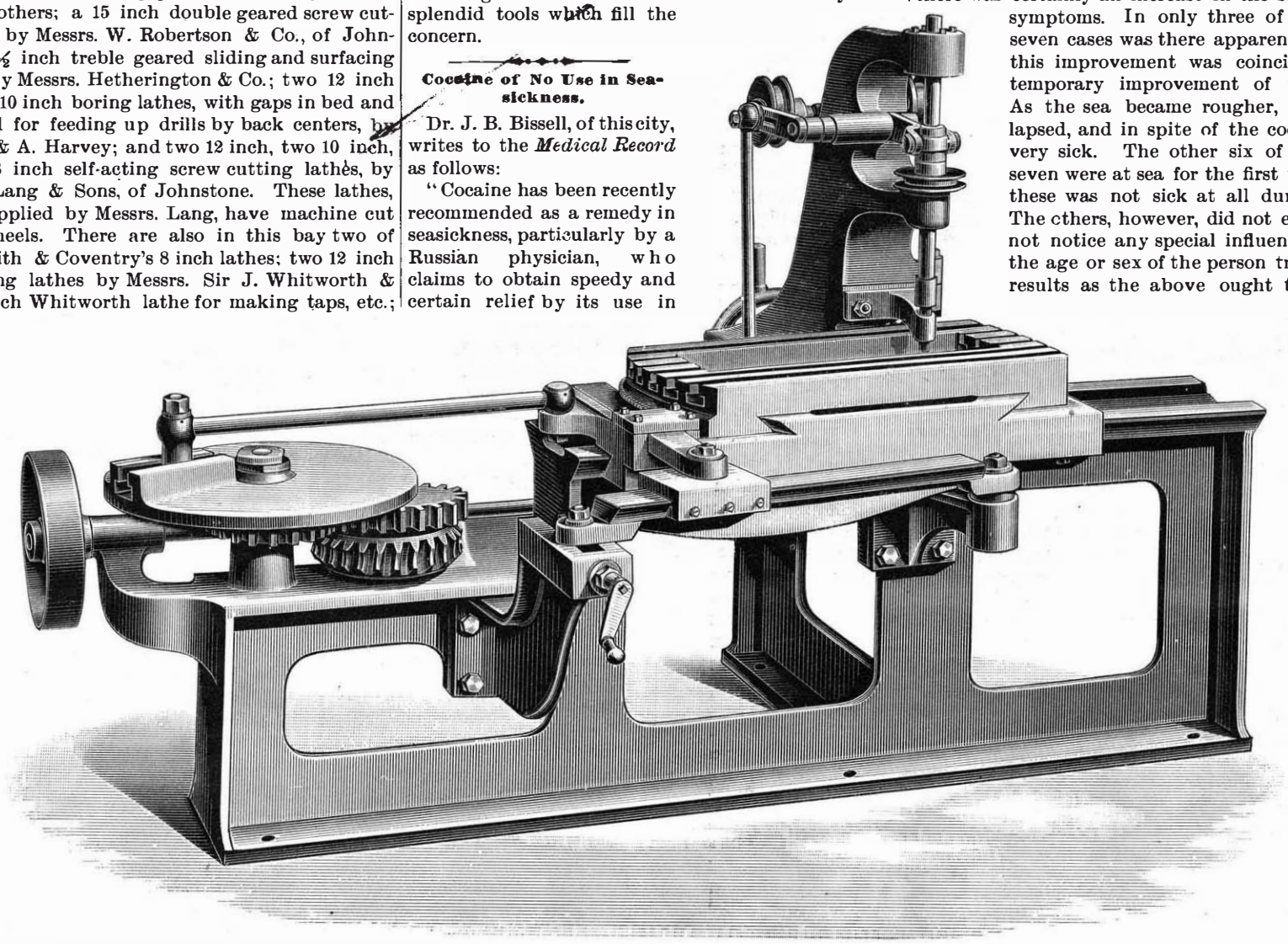
arrangement clearly. In the next bay we find the following machine tools, viz.:

A double geared 15 inch screw cutting lathe and a treble geared 14 inch gap lathe, both by Messrs. Craven Brothers; a 15 inch double geared screw cutting lathe by Messrs. W. Robertson & Co., of Johnstone; a 13½ inch treble geared sliding and surfacing gap lathe by Messrs. Hetherington & Co.; two 12 inch and three 10 inch boring lathes, with gaps in bed and clutch feed for feeding up drills by back centers, by Messrs. G. & A. Harvey; and two 12 inch, two 10 inch, and four 8 inch self-acting screw cutting lathes, by Messrs. J. Lang & Sons, of Johnstone. These lathes, like all supplied by Messrs. Lang, have machine cut toothed wheels. There are also in this bay two of Messrs. Smith & Coventry's 8 inch lathes; two 12 inch screw cutting lathes by Messrs. Sir J. Whitworth & Co.; a 7 inch Whitworth lathe for making taps, etc.; six single gear lathes by Messrs. Smith & Coventry; eleven hollow spindle lathes by the same firm; and eight bolt lathes by Messrs. G. & A. Harvey.

In the screwing department, we have a Barrow's patent screwing machine by Messrs. T. Shanks & Co.; two of Messrs. Smith & Coventry's 7 inch chasing lathes; two screwing machines, one by Messrs. Sir J. Whitworth & Co., and one by Messrs. Campbell, Smart & Co., of Glasgow; two four-spindle nut-tapping machines by Messrs. Craven Brothers; and two of Messrs. Sharp, Stewart & Co.'s duplex nut slotting machines. There are also two 12 inch slotting machines by Messrs. Fairbairn, having duplex tables, and one with a radius bar for slot links; three 6 inch and four 8 inch slotting machines, with compound tables, by Messrs. Sharp, Stewart & Co; two 6 inch geared slotting machines by Messrs. G. & A. Harvey; and two 6 inch slotting machines by Messrs. Campbell, Smart & Co. For preparing cutters there is one No. 3 machine tool grinder, one universal milling machine, and a machine grinder to use with it, all by the Brown & Sharpe Manufacturing Company, of Providence, R. I.

Our description is meager, and for lack of space we are obliged to omit the mention of the many other splendid tools which fill the concern.



MACHINE FOR GRINDING CASE-HARDENED WROUGHT IRON AXLE BOXES.

Cocaine of No Use in Seasickness.

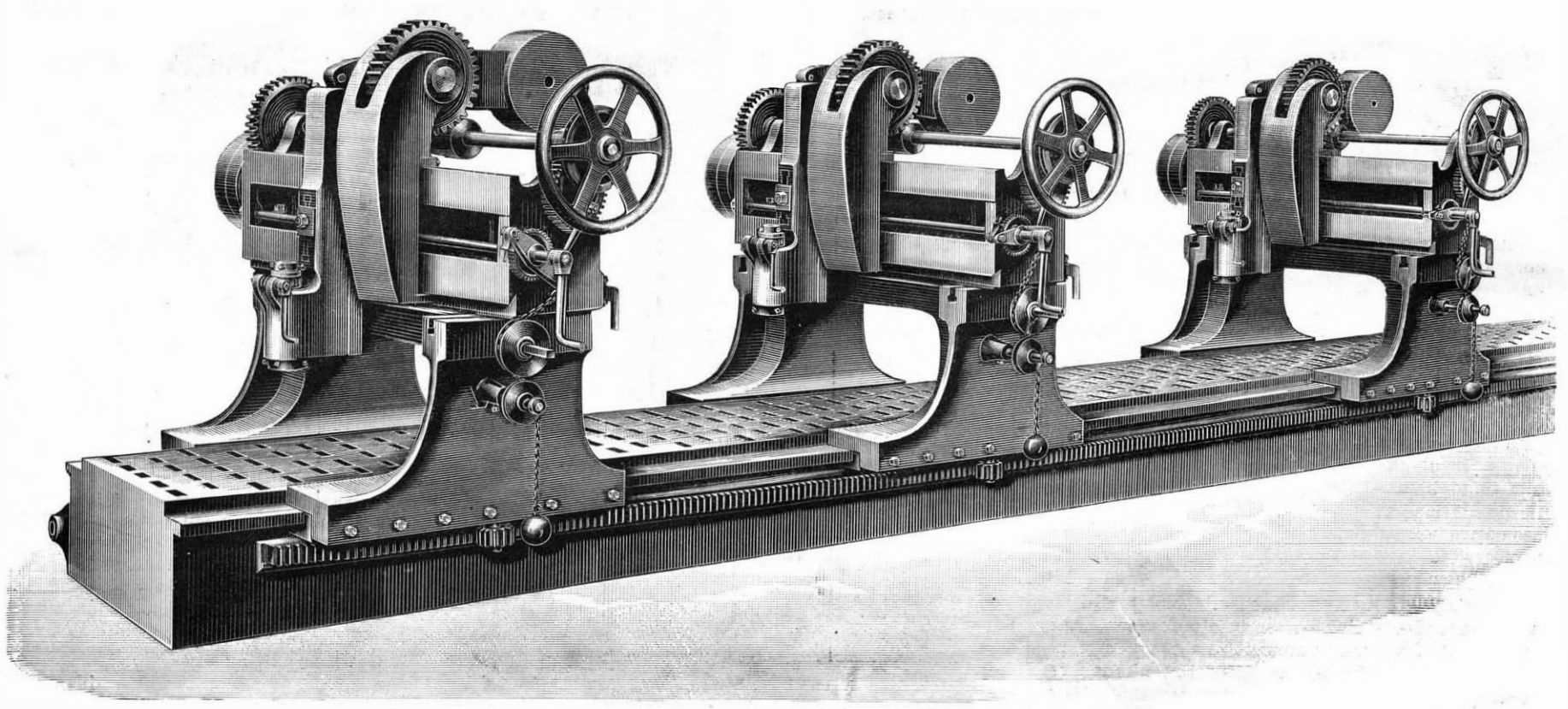
Dr. J. B. Bissell, of this city, writes to the *Medical Record* as follows:

"Cocaine has been recently recommended as a remedy in seasickness, particularly by a Russian physician, who claims to obtain speedy and certain relief by its use in this affection. In a voyage from New York to Charleston, S. C., made in November of last year, an excellent opportunity was afforded to ascertain the value of the drug in this regard. The time of passage was four days, the weather fair, and no storms, but a head wind lasted all the way. The experiments were made on twenty-seven persons of both sexes, and from four years of age to forty-eight. The hydrochlorate of cocaine, in doses of a twentieth and a twenty-fifth of a grain, in tablets, was given by mouth.

"In one set of cases, the medicine was begun soon after leaving the wharf; in another set, at the first symptom of nausea; in a third set, not till vomiting had taken place. In the first set, the dose was a twentieth of a grain, repeated every hour till two grains had been taken. In the other cases, a twenty-fifth every fifteen minutes up to two grains, or, as happened in nearly every case, till the patients became so sick that they refused to continue the drug. This was usually after the fifth or sixth dose. The results from these three sets of cases were almost precisely similar. In twelve cases there was no improvement, if the treatment did not positively make the patients worse. In six cases there was certainly an increase in the severity of the symptoms. In only three of the twenty-seven cases was there apparent benefit, and this improvement was coincident with a temporary improvement of the weather. As the sea became rougher, all three relapsed, and in spite of the cocaine became very sick. The other six of the twenty-seven were at sea for the first time. One of these was not sick at all during the trip. The others, however, did not escape. I did not notice any special influence exerted by the age or sex of the person treated. Such results as the above ought to dispose of cocaine as a remedy in seasickness; but as these results don't advertise any one's special method of administering the drug, or any firm's special preparation, it is very likely it will continue to be used till a newer remedy comes into fashion."

Iodaldehyd.

P. Chantard.—Iodaldehyd is a limpid, oily liquid, volatile, not inflammable, colorless, but blackening rapidly in the light. It is decomposed at 80°, and cannot be distilled unchanged, even at the pressure of 0·22 meter. It does not solidify at 20°. Its vapors attack the eyes and the respiratory organs so severely that it can be manipulated only in the open air. Its density is 2·14. It dissolves in all proportions in alcohol, ether, benzol, chloroform, and carbon disulphide. With ammonia it yields, at the ordinary temperature, the different terms of the series of oxaldines, according to the proportions.



IMPROVED FRAME PLATE SLOTTING MACHINE AT THE CLYDE LOCOMOTIVE WORKS, GLASGOW.

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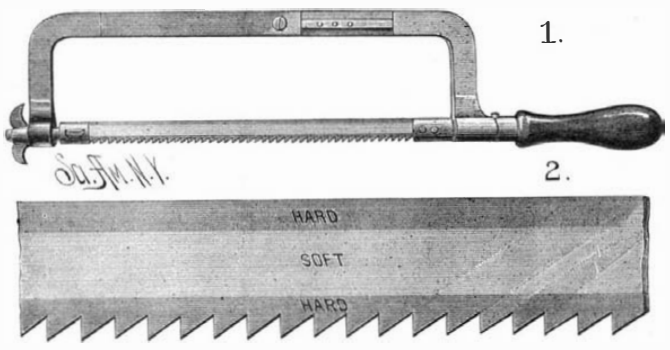
An Instantaneous Boiler.

M. Lestang describes, in the *Revue Industrielle*, a so-called instantaneous boiler, devised by M. Buisson. It is admitted that this problem has received considerable attention, but with not very satisfactory results. M. Buisson's arrangement consists of one or more steel cylinders, closed at one end, and covered at the other by a lid secured by six screws, and pierced with three holes. These vaporizers are from 20 to 36 inches long, and from 4½ to 9 inches in diameter. They are intended to be filled with material called by the inventors "metallic sponge," but consisting simply of small grains of iron, coppered in order to prevent waste by the steam.



CLEMSON'S IMPROVED SAW.

Through one of the holes in the cover a copper tube descends nearly to the bottom of the cylinder, where it terminates in a capillary opening. The steam outlet pipe is connected with another of the holes, the third hole being for charging the cylinder with granular material. The cylinder thus charged is placed in any convenient furnace for making it red hot. Water is then injected into it by means of a pump, and high pressure steam is instantly generated. This pump may, of course, be driven by the engine, which is supplied with the steam. There are means of regulation, whereby the quantity of water injected, and consequently of steam generated, depends upon the demands upon the engine. The injecting pump is thus a capital feature of the arrangement. It will be seen that this system of steam raising is primarily intended for the class of domestic motors, an essential feature of which is that the boiler must not be liable to explosion or to injury by neglect in supplying water or by overfiring. In these tubes there is nothing to be damaged, even if they are left in the fire for any length of time without water.

AUTOMATIC DAMPER REGULATOR.

The accompanying cuts represent a new, cheap, and simple device for regulating the draught in furnaces of steam boilers. This damper regulator (shown in section in Fig. 2) consists of but few parts, and contains no packing of any kind. The piston head is a loose fit in cylinder, and has a small hole through it for drainage, which is led off through a small pipe from the bottom of cylinder. The valve case contains a small valve, a steel spring, and an adjusting screw, with a milled wheel for setting the tension on the spring to vary the pressure required on the boiler; after once being set the machine is automatic, opening and closing the damper on a variation of only 1½ lb. of steam.

The regulator is adapted for use either on the ash pan dampers or dampers in the smoke pipe. When used on a locomotive, the regulator is fastened to a bracket on the left side of the boiler front, and connected to a rock shaft and thence to the dampers, as shown in cut, Fig. 1, so one or both of the dampers can be used. It has been found by actual test that the saving of fuel by the use of the regulator is one-sixth. This is caused by the regulator keeping the fire at an even heat, and closing in time to prevent the steam blowing from the safety valve, also by making it unnecessary to open the furnace door for relief, and thereby cooling the furnace sheets and causing the tubes to leak.

Its use permits the engineer to carry a regular feed. At the present time these regulators are in use on stationary, steamboat, and locomotive boilers, and are particularly serviceable, as no jar or motion affects them. The present style weighs 5 pounds, is 12 inches long, and 1½ inches in diameter. The inventors propose to soon make a smaller size for use on small boilers.

Further information can be had by addressing Mr. C. W. Townsend, Box 19, Newburg, N. Y.

AN IMPROVED SAW.

This saw is made of sheet steel in the usual way, with teeth upon one edge; but instead of being hardened upon one edge only, both edges are hardened simultaneously, the center or body of the saw being allowed to remain soft. By this method of construction the expansion of one edge of the saw due to hardening is opposed and counteracted by the expansion of the other edge, so that the saw remains straight. This also secures a very hard and durable cutting edge, and produces a tough and flexible saw, not liable to break.

This saw is the invention of Mr. Geo. N. Clemson, of Middletown, N. Y.; the sole agents are the Millers Falls Co., of 74 Chambers St., New York city.

Waterproofing Paper.

A new composition for waterproofing paper consists of the following ingredients, combined in the proportions stated, viz.: Resin, 50 per cent; paraffine, 45 per cent; silicate of soda, 5 per cent. These ingredients are thoroughly mingled by heating them together, and by agitation.

The paper to which the composition is applied is usually building or sheathing paper. The latter is taken in the condition in which it comes from the paper machine, being quite dry. A strip or strips of the paper, from a roll or other convenient holder, are conducted and drawn through the tank of hot composition, whereby the paper becomes well saturated with it, and upon emerging from the tank the paper passes between suitable rolls, which press any surplus composition from it, leaving it hard and smooth.

Sometimes the proportions of resin and of paraffine are varied from 5 to 15 per cent from those stated, retaining about 5 per cent of silicate of soda. Thus the proportions of resin and paraffine may vary between 50 and 65 per cent of the former and between 45 and 30 of the latter, making a composition by which the paper is rendered waterproof and durable, when exposed to the weather, and by means of which a surface finish both smooth and hard is obtained.—*Paper Trade Journal.*

A Thrifty Life Insurance Company.

The forty-first annual statement of the New York Life Insurance Company, which is published in another column, makes a very favorable showing, notwithstanding the depression of the last year in nearly all branches of business.

The New York Life Insurance Company has a surplus of several millions of dollars, and its officers and trustees are recognized as among our most substantial and trustworthy citizens.

This company issues all classes of policies, including non-forfeiture, non-contestable on account of suicide, Tontine investment policies, etc. Their rates for premiums, under their different classes of policies, are liberal, and in all respects the company's affairs are conducted with a business-like sagacity and due regard for the interests of its stockholders and policyholders.

Complementary Colors.

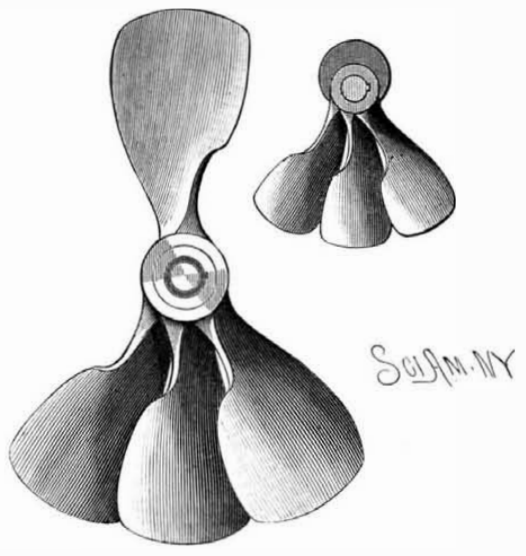
Select several cards of different colors, and in the center of each fasten by a little mucilage a small round piece of black paper. Place over the card thus prepared a piece of thin white tissue paper. The variety of hues which the black assumes is very striking.

A NEW SCREW PROPELLER.

The propeller here shown does not differ in any way from those of the usual construction, except that the blades are so placed or grouped about the hub as to be unequally distributed; in other words, there are, as in the example shown in the engraving, three blades upon one side of the hub and one heavy blade or a counterbalance weight upon the other. In extensive trials lately made at the Washington Navy Yard, under the supervision of a board of engineer officers, this propeller was found to be superior to the old form in regard both to speed and backing power. In addition, the engine turned centers much more easily with the new form—which is the invention of Mr. A. Vogelsang, of 347 Jay St., Brooklyn, N. Y.—and there was less vibration and thumping.

During these tests the new propeller was of the form shown in the large cut; the screw used by the board had four blades, equally spaced, 34 inches in diameter and 54 inches pitch. The diameters, number of blades shape of blades, surface area, and pitch were alike in both propellers, so that the only actual difference in the two was in the manner of arranging the blades. The new form developed far more power with less number of revolutions, under conditions as nearly similar as possible, thus showing that it had a firmer hold upon the water, and consequently less slip.

It is not necessary that the counterbalance should be so formed as to have a propulsive effect, since a propeller made with a weighted hub, as shown in the small cut, has given decidedly superior results.



VOGELSANG'S NEW SCREW PROPELLER.

The Tehuantepec Ship Railway.

New and important concessions were granted toward this great work on December 10 by the Mexican Congress, by adding to the previous land grants 1,700,000 acres, which makes the entire land ceded to the company about 2,700,000 acres, equal in area to more than twice the area of the State of Delaware. Coaling stations will be permitted at either end of the railway, to which coal from the United States or any other foreign nation co-operating with Mexico in guaranteeing interest on the bonds of the railway company will be admitted free of duty, to the exclusion of coal from all other countries.

Mexico guarantees that the income of the company shall not be less than $1,250,000 a year for fifteen years, provided that our country, or some European nation, guarantees income to the amount of $2,500,000 more for the same period. In other words, if the income of the company from its business should fall below $3,750,000 per annum, the subscribing governments are to make good the remainder. The time for completing the road has also been extended to 1894. Owing to the encouragement given by President Cleveland, a movement has been started at Washington to obtain favorable action from Congress. Senator Morgan, of Alabama, succeeded in having a resolution adopted calling upon the President for a report on the proposed railway. A large number of people are deeply interested in the enterprise, and some important steps for its advancement will probably be taken during the winter.

A CORRESPONDENT suggests the need of a discovery or invention for preventing trichinæ in hogs, thus putting an end to the losses of life and property which this parasite causes. Here is something for ingenious minds to think of.

Fig. 1.

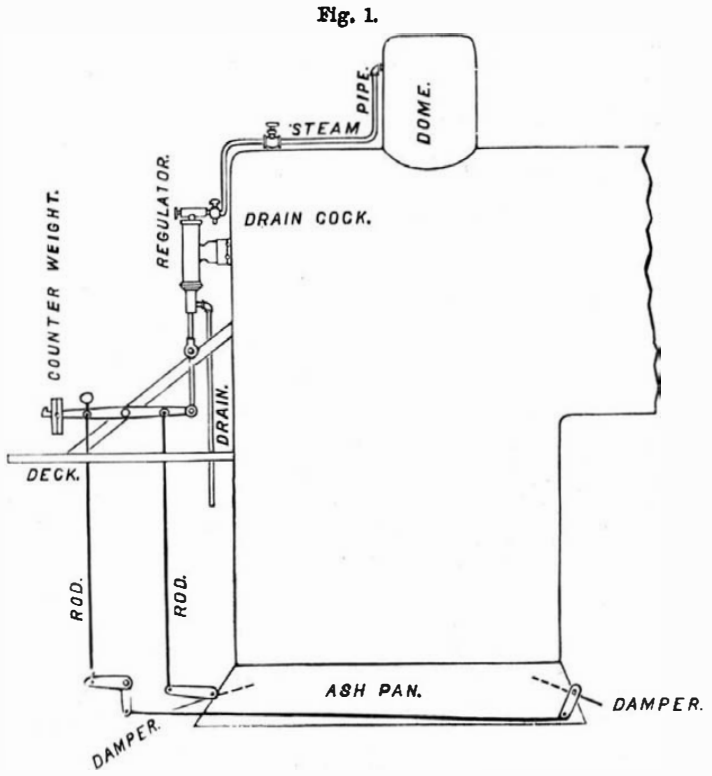
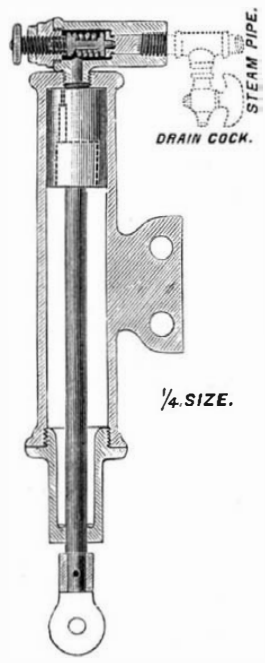


Fig. 2.



McDONALD & TOWNSEND'S AUTOMATIC DAMPER REGULATOR.

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Correspondence.

Origin of the Telephone.—Prof. Bell, Sr., Replies to Dr. Lawson Tait.

To the Editor of the Scientific American:

My attention has just been called to a communication from Dr. Lawson Tait, of Birmingham, recently published in the SCIENTIFIC AMERICAN. Dr. Tait thinks that he has discovered a "missing link," in reference to the origin of the telephone. In developing his idea, Dr. Tait does me the honor to recall my name as that of a "very well-known man in Edinburgh" during his student years at the university; and he "feels almost certain" that he has seen me as "one of the frequenters" of a shop where Reis' telephone was exhibited in December, 1862. He further "thinks it extremely likely" that I would go to the shop to see the telephone, and that I "might have been accompanied" by my son. Dr. Tait adds that "nothing is more likely than that it was through this chain that Reis' telephone was transferred to America, and there became developed."

Allow me to state that Dr. Tait's conjecture is entirely baseless. So far from being a "frequenter" of the shop referred to, I was never within its doors; and I never even heard of Reis' telephone until years after 1865, when I left Edinburgh. My son, at the date specified by Dr. Tait, was fifteen years of age, and a pupil at the high school.

Knowing all the stages of my son's laborious efforts before he finally achieved the telephone, I know that his work was not suggested, or directed, by anything that Reis had done. At the time the telephone first began to speak, the whole world was astounded. The very idea was entirely new. Had Reis' instrument transmitted speech in 1862, how came it that the fact failed to be recognized as the marvel it undoubtedly must have been accounted? There is only one explanation. The sounds conveyed by Reis' instrument sometimes resembled words, or parts of words—as musical notes often do to imaginative listeners; but, as a matter of fact, Reis' telephone, without modification in accordance with the principle discovered by Alexander Graham Bell, has never, to this day, accomplished the transmission of an articulate sentence.

ALEXANDER MELVILLE BELL.

Washington, D. C., Feb. 8, 1886.

Right and Left Handed.

To the Editor of the Scientific American:

In your issue of Jan. 16, page 37, I see an article by Charles W. Noel, in regard to right and left handed men, in which he states that nearly all right handed men use the right hand on the end of the shovel. That is not always the case among miners, but I have taken the census of a number of camps, to see if I could find one left handed man who used his left hand for the fulcrum, or his right hand on top of his shovel, and I never found one, unless he worked both handed. Even then the preference was always given to the left hand, when convenient. I am right handed in everything, but have acquired the skill to use both hands to a certain extent, and can shovel a little left handed, *i. e.*, with left hand behind, or on top of a short handled shovel, but all the difficulty I find is to guide the tool with the left hand, as it is the hand having hold of the end of any two handed tool that guides it; the foremost hand is only the rest, you may call it, though in shoveling it has the heaviest part of the work to perform.

I have been a reader of the SCIENTIFIC AMERICAN for many years, as your subscription list will show, and I distinctly recollect seeing the question correctly decided in "Notes and Queries" a long time ago. Why the decision should now be reversed is a mystery.

Mr. Noel is undoubtedly correct, although among all laboring men, right handed men are called left, and *vice versa*, when using a tool that requires both hands. It is about time the correction was made, and the SCIENTIFIC AMERICAN is the very one to commence it, seeing that it reaches so many of the thinking class of laboring men. CHAS. J. BARCLAY, *Miner*.

Gibbonsville, Idaho, Jan. 26, 1886.

The La Guayra and Caracas Railway.

To the Editor of the Scientific American:

Although shunning notoriety, I cannot, in justice to myself, allow the leading article in your SCIENTIFIC AMERICAN SUPPLEMENT of Nov. 21, 1885, to pass without notice. My attention was called to it only a few days ago, otherwise I would have commented on it sooner.

Without going into detail or unnecessary explanation, or considering it a very wonderful engineering achievement, I am impelled, since you have drawn the attention of the profession, in your widely circulated journal, to the La Guayra and Caracas Railway, in Venezuela, S. A., to claim that it was constructed substantially on my plans and the location made by me, and that the map published by you is compiled from my maps, and not from Mr. Livesey's, who never, to my knowledge, saw the country before the road was located and mostly constructed, if, indeed, he has even yet done so; and I am positive he has no definite knowledge of the engineering part of the work, except such as he may have acquired from a study of my maps and reports.

During the progress of the work of making the final location, the official newspaper published in Caracas, Venezuela, was furnished, as it progressed, with a reduced copy of the adopted plan of the line, which it published regularly. Copies of the paper were sent by me to the rooms of the American Society of Civil Engineers, in New York, of which I am a member, where any one can have access to them, and from which they will find that the maps are attested by "John Houston," Chief Engineer, and "Augustus Plinta," Assistant Engineer. Mr. Livesey's name will not be found there.

Without wishing to encroach further on your space, I would like to say briefly that the work had been commenced years before General Pile undertook to finish it, and that an immense amount of money had been expended upon it. It was then abandoned as almost impracticable, the *Boqueron*, of which you have such an excellent illustration, being considered an almost insurmountable difficulty. By a change of many miles of the line, and a consequent abandonment of much finished roadbed, which remains as a not very complimentary monument to some engineer, the road was relocated and constructed by me; and, if I can help it, I do not purpose, after expending many weary months in Venezuela of my best efforts in the undertaking, and being obliged to return to the United States in impaired health, to allow any one to claim whatever credit there may be in the accomplishment of what has attracted considerable notice in the scientific press. JOHN HOUSTON,

Member American Society of Civil Engineers.

Jersey City, N. J., Feb. 16, 1886.

The Building Prospect of 1886.

The apprehension among builders in the cities of New York and Brooklyn, in respect to the labor question, is such that some of our prominent contractors decline to negotiate for spring business. And from other parts of the country we hear of the same conservatism manifested among the builders. The last issue of the *Northwestern Lumberman*, published at Chicago, foreshadows the same apprehension, which is felt elsewhere.

Contractors, and those intending to have buildings erected, the editor says, will act the part of wisdom if they urge forward their work to completion before May 1, where that is possible. One of two things is nearly certain, and both are likely to be verified; that is to say, there is to be an eight hour movement started about May 1, with more or less resulting labor disturbance, and probably wages for the season to come will be higher than last year; and material will cost more. We are either to have a great revival of industry and business in the near future, beginning with the opening spring, or we shall be liable to a collapse that will be more serious than the depression of the past two years. The signs are favorable to the more cheerful conclusion. The railroad systems of the country are preparing for new construction on a large scale. If they go ahead, there will be a great absorption of surplus labor and an urgent call for material of all kinds, which will include lumber and other stuff that enters into the building trades. This must tend to rising prices for both labor and material. The effect of the revival will not be felt till early in the summer. The men who buy and use before May will be quite apt to make their investments at the right time. Those who procrastinate may pay dearly for it.

A National Museum of Hygiene.

There is in Washington, corner Eighteenth and G Streets, a national museum of hygiene, of which J. Mills Browne, medical director in the United States Navy, has charge, and which has over 7,300 volumes, including the standard sanitary books in the English, German, and French languages, besides some eight hundred different objects illustrating sanitary improvements in plumbing, lighting, heating, ventilation, water supply, bedding, clothing, marine, house, and hospital architecture, the disposal of refuse, the disposal of the dead, and many other things which affect the health.

Two hundred and twenty articles represent the advance of sanitary engineering, including the drainage of houses, sewerage of cities, etc. Some of these show the improved inventions of the present day, while others show the faulty construction of past systems. One piece of lead pipe, very much incrusted and foul, was taken from the Executive Mansion in 1880. Another piece of lead pipe, taken from the residence of Dr. Philip S. Wales, ex-Surgeon-General of the Navy, shows two holes—one where a rat gnawed his way in and another where he made his exit. This illustrates a common danger in house plumbing. Another extensive exhibit is that presented by a firm of English plumbers. It shows many very bad examples of plumbing. On the rear, outside of the building, there has been erected a complex system of pipes and fixtures, with which a complete series of experiments, showing the effects of siphonage, ventilation, etc., is being carried out.

The section of food and drink is represented by exhibits illustrating improved and defective methods of preserving food, photographs and engravings of food plants and of poisonous ones closely resembling them, samples of food provided for Arctic expeditions, and specimens of liquors aged by electricity. Here is shown the pitiable substitute for food found in the pot at the Greely camp when his party was rescued. It is a piece of sealskin and some moss and shrimps, of which they were trying to make soup when found. It was absolutely their last supply. The hygiene of dress is represented by a complete suit of underwear, recommended by the Ladies' Dress Reform Association. There is also a complete suit of the woolen clothing advocated by Jaeger, who goes to the extreme of using woolen collars and cuffs, and of having the stockings divided for the toes, as gloves are for the fingers. In the division of appliances for protection and rescue are shown models of life-saving rafts and boats, colliery ambulances, army ambulances, disinfecting ovens, etc. The branches of military and naval hygiene are fully represented. There are models to show superior ship construction and ventilation. There are other models of hospital ships. The division of sanitation, showing the disposal of the dead, is interesting. There is an exact model of the building used by the United States Cremation Company, at East Williamsburg, L. I. An ancient burial urn, recovered from Roman ruins, is shown.

Another model shows the Parsee "Tower of Silence." The original may be seen just outside the city of Bombay. It is in a beautiful garden on the crown of Malabar Hill, and the tropical trees surrounding the place are the homes of innumerable vultures. The tower itself is not a high structure, but is a two-story circular building without a roof. The floor of the second story inclines toward the center, and is laid out in plats large enough to receive a dead body. These plats are floored with an iron grating open to the floor or pit below. The body of the dead Parsee is laid in one of these open plats, and immediately becomes the prey of the hovering vultures. When the bones are denuded of flesh by the birds, they either fall through the grating or are thrown down into the pit beneath by an attendant. In the case of the more wealthy classes, the bones are sometimes taken away and preserved. The Parsee believes the action of the vulture is an index to the future disposition of the soul of the deceased. If the right eye is the first one to be plucked out by the feathered oracle, the soul is to rest in the heaven of all good Parsees; but if the left eye is taken, the soul encounters the opposite fate.—*American Analyst.*

Low Temperatures.

According to Herr Olszewski (*Comptes Rendus*), the gas that is the subject of experiment is inclosed in the innermost of three concentric tubes, the two outer spaces being filled with liquid oxygen, and the whole surrounded by liquid ethylene. Very low temperatures can thus be ontained, and the author has solidified nitrogen, carbonic oxide, methane, and nitric oxide. By the evaporation of solid nitrogen under a pressure of 4 mm., a temperature as low as —225 degrees was obtained. Liquid ethylene boiling under a pressure of 1 mm. has a temperature of —162 degrees, and remains perfectly transparent. Liquid air boiling under a pressure of 10 mm. has the temperature —220 degrees, and even under a pressure of 4 mm. shows no signs of solidification. A liquefied mixture of air and nitrogen, in equal volumes, has the temperature —220 degrees under a pressure of 13 mm., and remains liquid and transparent under a pressure of 4 mm. Hydrogen shows no meniscus, even at —220 degrees, under a pressure of 180 atmospheres. A mixture of two volumes hydrogen and one volume oxygen was cooled to —213 degrees under a high pressure. The liquid obtained was perfectly colorless, and boiled rapidly when the pressure was released, losing the greater part of its hydrogen, after which it remained liquid for some time under atmospheric pressure. The *Journal of the Chemical Society* says the author maintains the accuracy of the hydrogen thermometer at very low temperatures.

Drop-Forged Copper.

Mr. C. E. Billings, of Billings & Spencer Co., of Hartford, Conn., after a great deal of patient experimentation has succeeded in producing drop-forgings in copper. Pure copper connectors, screws, and other parts of electrical apparatus have hitherto been unobtainable, owing to the difficulties experienced in casting copper. It has been the practice to add to the copper a small proportion of tin to insure a homogeneous and smooth casting, but the tin interferes with the conductivity of of the metal; its presence is therefore undesirable. Mr. Billings' efforts will be appreciated by manufacturers and users of electrical apparatus.

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ENGINEERING INVENTIONS.

A railroad supply tank has been patented by Mr. John Stone, of Plattsburg, Mo. This invention covers improvements in a style of apparatus by which the train wheels act to elevate water into a tank from which the locomotives can take their supply, the work being done automatically.

A passenger car has been patented by Mr. Bruce Price, of New York city. This invention consists principally in forming bay windows at the sides of the car, and in forming recesses or coves above the windows, to which fenders or brackets are applied for receiving and holding parcels.

An electric motor has been patented by Mr. Joseph Weis, of Jersey City, N. J. Combined with the brush holders and their frames are springs, slides with inclined shoulders, and a slide operating lever, whereby the brushes can be readily adjusted to regulate the direction of the current, and any desired amount of resistance can be thrown into the current.

A steam actuated valve has been patented by Mr. John T. Tooley, of East Saginaw, Mich. Between the steam chest and the cylinder is an auxiliary steam chest with an auxiliary valve, with other novel features, whereby stumps will work with regularity, and will not be left on the dead center at starting or stopping.

A mining drill has been patented by Mr. William H. Jenkins, of Irwin, Col. The cam is made to operate singly instead of in pairs, thus dispensing with the need of a shaft running through its face, and the lifting pin is of semi-cylindrical shape, to utilize the entire face of the cam for compressing the spring, and enable its force to be fully realized, with other novel features.

AGRICULTURAL INVENTIONS.

A band cutter has been patented by Mr. John Henry, of Ardoch, Dakota Ter. It has knives with serrated edges to cut either wire or twine bands, with which grain bundles are tied, as they are fed to a thrasher, with fingers to hold them firmly and do the work automatically.

A combined hay rake and cocker has been patented by Mr. Samuel Olson, of Cyrus, Minn. This invention covers a novel construction and combination of parts for a machine to gather hay from a meadow, form it into cocks, and deposit the cocks upon the ground automatically.

MISCELLANEOUS INVENTIONS.

Parturition shears form the subject of a patent issued to Mr. Alexander Cullon, of Lindsay, Ont., Canada. They are for the use of veterinary surgeons, and intended to be effective in operation, while not liable to cause accidental injury.

A dovetailing machine has been patented by Mr. John G. Oetzel, of Brooklyn, N. Y. It is designed especially for use in making furniture, cutting grooves in lumber, or other woodworking, and embraces various novel features of construction and combination of parts.

A necktie fastener has been patented by Mr. John F. Pope, of Ottumwa, Iowa. It is a slotted plate adapted to be attached to the collar button, with a frame for the scarf adjustably attached to the plate, bands being provided with metal stiffening, whereby the tie may be held in place or easily removed.

A honey extractor has been patented by Mr. William B. Treadwell, of New York city. It is operated by centrifugal action, and in combination with the swinging comb pockets is a device for connecting together their spindles, so that the entire series of pockets may be reversed simultaneously.

A buckle has been patented by Mr. Samuel Bretzfield, of New York city. It consists of a plate with flange and slot, making a simple construction by means of which the belt can be adjusted to fit waists of different sizes, while the buckle may be made very handsome in appearance.

A box fastener has been patented by Mr. Edward Harris, of Cambria, Wis. It consists of a U-shaped wire or key held in one end piece of the cover and adapted to be passed through a slot in the corresponding end piece of the box, to hold the cover securely while being easily fastened or unfastened.

A bustle has been patented by Mr. Aaron Stern, of New York city. It is made of plaited or braided straw, reed, rattan, or other suitable fiber, with a stiffening strip sewed along the bottom edge, and independent stiffening strips from the top edge to the bottom edge.

A washing machine has been patented by Mr. John W. Overman, of Fort Fetterman, Wyoming Ter. Combined with a revolving tub on a spindle is a ribbed fixed cylinder in the middle of the tub, and a curved washboard in the tub, so constructed that large or small articles may be washed easily and rapidly thereby.

A plotter for draughting has been patented by Mr. Milton E. Thompson, of Bartow, Fla. It consists of a novel combination of straight edges, pivots, and connecting rods, for making perspectives and like drawings, and the instrument can also be used for drawing parallel lines.

A machine for washing phosphate rock has been patented by Mr. Earle C. Bacon, of New York city. It has pipes with swiveled or ball-shaped jointed nozzles, in combination with inclined screening bars, with frame supporting the bars, and an inclined floor, the pipes being located on the four sides of the frame.

A thill coupling has been patented by Messrs. Abijah L. Romans and John M. Peregrine, of Jamestown, N. Y. It consists of a special construction of an anti-rattler and bolt-holder, combined with a thill coupling and bolt, and which may be applied to common thill couplings and bolts without any change.

A cutter head has been patented by Mr. William G. Rendall, of Portland, Oregon. It is a novel construction of spiral rotatable cutter head, to be operated from any suitable frame having pulleys and belts, for rotating it as it is pressed to the work, and is more particularly adapted for use in felling trees and for cutting off driven piles while building wharves or other structures.

An ore separator has been patented by Mr. Alonzo C. Campbell, of Nashville, Tenn. The construction is such that the pan is vibrated during the whole operation, the pulverized ore being introduced on a covering of duck or other suitable material with meshes of the desired fineness, a current of air or water raising this covering in curved form, and the tailings being discharged at one place and the concentrates at another.

A siding for buildings has been patented by Mr. Albert C. Daugherty, of North Belle Vernon, Pa. The tongue and groove of the sidings are peculiarly formed to present an inclined edge to conduct water from the joints, and they are chamfered so the edges present the appearance of blocks of stone, an illusion which may be heightened by sanding the boards for the kind of stone to be imitated.

A design for a sash fastener has been patented by Messrs. William Huttig, Sr., and Nicklas Bart, of Muscatine, Iowa. It presents a novel configuration of a window sash fastener, having generally a flat appearance, the head portion having a circular outline ornamented by angular projections and an eccentric eye, and the tail being tapering, with approximately straight and curved outlines.

NEW BOOKS AND PUBLICATIONS.

CAWKER'S AMERICAN FLOUR MILL AND MILL FURNISHER'S DIRECTORY. Milwaukee: Riverside Printing Company, 1886.

This convenient little pocket volume of 137 pages gives the names and post office addresses of the flour mill owners in the United States and Canada, together with a list of American millwrights and brokers and European flour importers. Where possible, information has been added respecting the amount of capital invested; the system of grinding employed; the daily capacity of the mill in barrels of flour; and the nature of the power in use. The directory is neatly bound in imitation alligator. It will be found of much value to mill furnishers and others desiring to reach the flour industry.

THE CONSTRUCTION OF TRUSSED ROOFS. By N. Clifford Ricker. New York: William T. Comstock.

The author, Professor of Architecture in the University of Illinois, has prepared this work as a manual of instruction, as well as for private study or for reference. The first chapter is a treatise on elementary graphic statics, so far as necessary to understand their application to trussed roofs, and the formulæ and tables presented are intended to be of great convenience to architects.

A MANUAL OF INDUSTRIAL DRAWING FOR CARPENTERS AND OTHER WOOD WORKERS. By W. F. Decker. New York: William T. Comstock.

This is a manual adapted for practical mechanics as well as students. It not only shows how to make working drawings, but explains their advantages, and how to follow them in carrying out the ideas of architects and others. It includes a full set of working drawings of a modern house, built under the supervision of the writer, the drawings having been made from the architect's plans.

JAPANESE HOUSES AND THEIR SURROUNDINGS. By Edward S. Morse. Boston: Ticknor & Company.

For cultivated people of small means, desiring to build for themselves, and having tastes which lead them to take pleasure in beautifying their homes and surroundings, where this can be done in an inexpensive way, we know of no other publication so brimful of suggestion and valuable information as this handsome and profusely illustrated volume. We do not mean in saying this to have any one infer that the book is not equally well worth the attention of those who can build brownstone houses, or of the architects who design the most costly residences, for of the latter structures too many are wanting in many of the essentials to comfortable living that are generally found in less pretentious buildings; but the conditions of life in Japan, and the genius of its people, are such that we often find in their work the development of an exquisite taste that makes the commonest articles they produce a source of constant pleasure. How this taste and Japanese constructive ingenuity are manifested in their residences, in those of the humblest as well as those of the higher classes, the work of Professor Morse points out in ample detail and in most attractive style. Commencing with the appearance of the city and the village, there follows a description of leading types of houses, their materials of construction, the workmen and their tools; and then more than 200 pages are given to "interiors," from which we fancy many of our professional "decorators," who make "studies" of private residences, churches, etc., in order to obtain pleasing and harmonious effects, can easily obtain some most valuable lessons. The entrances and approaches of the house, its gardens, and a wide variety of other matters naturally connected with the subject, receive their due proportion of attention, and one lays down the volume with an impression that he has, during its perusal, got upon terms of rather intimate acquaintance with our far away neighbors off the Asian coast.

A Portfolio of Rare and Beautiful Flowers is the title of a well edited and exquisitely printed description, accompanied by six colored plates, of roses and pansies, the passion flower, pitcher plants, and three varieties of orchids. The plates are on heavy paper, 11½ by 14½ inches in size, and are from original work by Mr. John Walton, a flower painter of admittedly high merit. The portfolio is well worth a place on any parlor or drawing room table. James Vick, publisher, Rochester, N. Y.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

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There is no reason why you should not make large sums of money if you are able to work. All you need is the right kind of employment or business. Write to Hallett & Co., Portland, Maine, and they will send you free full information about work that you can do and live at home, earning thereby from $5 to $25 per day and upward. Capital not required; you are started free. Either sex; all ages. Better not delay.

"Shortness of breath
Caused my death,"

is inscribed on a tombstone in an English graveyard. In all probability it would never have been necessary, if only the poor unfortunate victim of some disease of the respiratory organs had known of Dr. Pierce's "Golden Medical Discovery," which is a panacea for all diseases of the throat and lungs. For consumption, it is believed to be the only real specific yet known. For all scrofulous and blood diseases it is unfailing.

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Pat. Geared Scroll Chucks, with 3 pinions, sold at same prices as common chucks by Cushman Chuck Co., Hartford, Conn.

Tools, Hardware, and other specialties made under contract. American Machine Co., Philadelphia.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Pumps for liquids, air, and gases. New catalogue will be ready in March.

Tunneling Under the Hudson River. Giving full particulars of the prosecution of the work thus far. With working drawings, in 27 handsome plates, showing all details. By S. D. V. Burr. $2.50. For sale by Munn & Co., 361 Broadway, New York.

Catarrh, Catarrhal Deafness, and Hay Fever. Sufferers are not generally aware that these diseases are contagious, or that they are due to the presence of living parasites in the lining membrane of the nose and eustachian tubes. Microscopic research, however, has proved this to be a fact, and the result is that a simple remedy has been formulated whereby catarrh, catarrhal deafness, and hay fever are cured in from one to three simple applications made at home. A pamphlet explaining this new treatment is sent free on receipt of stamp by A. H. Dixon & Son, 305 King Street West, Toronto, Canada.—*Christian Standard.*

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The Windmill as a Prime Mover. Comprehending everything of value relating to windmills, their use, design, construction, etc. By A. R. Wolff. With many fine illustrations. (Shortly.) 8vo, cloth. Price, $5.00. For sale by Munn & Co., 361 Broadway, New York.

Woodw'kg. Mch'y, Engines, and Boilers. Most complete stock in U. S. Prices to meet times. Send stamps for catalogues. Forsaith M. Co., Manchester, N. H.

Shafting, Couplings, Hangers, Pulleys. Edison Shafting Mfg. Co., 86 Goerck St., N.Y. Send for catalogue and prices.

The Knowles Steam Pump Works, 44 Washington St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

Haswell's Engineer's Pocket-Book. By Charles H. Haswell, Civil, Marine, and Mechanical Engineer. Giving Tables, Rules, and Formulas pertaining to Mechanics, Mathematics, and Physics, Architecture, Masonry, Steam Vessels, Mills, Limes, Mortars, Cements, etc. 900 pages, leather, pocket-book form, $4.00. For sale by Munn & Co., 361 Broadway, New York.

Machinery for Light Manufacturing on hand and built to order. E. E. Garvin & Co., 139 Center St., N. Y.

Send for Monthly Machinery List
to the George Place Machinery Company,
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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

Supplement Catalogue.—Persons in pursuit of information of any special engineering, mechanical, or scientific subject, can have catalogue of contents of the SCIENTIFIC AMERICAN SUPPLEMENT sent to them free. The SUPPLEMENT contains lengthy articles embracing the whole range of engineering, mechanics, and physical science. Address Munn & Co., Publishers, New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Wood Working Machinery. Full line. Williamsport Machine Co., "Limited," 110 W. 3d St., Williamsport, Pa.

Iron Planer, Lathe, Drill, and other machine tools of modern design. New Haven Mfg. Co., New Haven, Conn.

Curtis Pressure Regulator and Steam Trap. See p. 350.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 46.

Hercules Lacing and Superior Leather Belting made by Page Belting Co., Concord, N. H. See adv. page 46.

Cutting-off Saw and Gaining Machine, and Wood Working Machinery. C. B. Rogers & Co., Norwich, Conn.

Iron, Steel, and Copper Drop Forgings of every description. Billings & Spencer Co., Hartford, Conn.

Bradley's improved Cushioned Helve Hammer. New design. Sizes, 25 to 500 lb. Bradley & Co., Syracuse, N. Y.

Cyclone Steam Flue Cleaners are the best. Crescent Mfg. Co., Cleveland, O.

Curtis Damper Regulator for draught and steam pressure in boilers. Curtis Regulator Works, Boston, Mass.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

Hoisting Engines. D. Frisbie & Co., Philadelphia, Pa.

Tight and Slack Barrel Machinery a specialty. John Greenwood & Co., Rochester, N.Y. See illus. adv., p. 93.

Metallic Pattern Letters and Figures to put on patterns of castings. H. W. Knight, Seneca Falls, N. Y.

Manufacture of Soaps, Candles, Lubricants, and Glycerine. Illustrated. Price, $4.00. E. & F. N. Spon, New York.

Astronomical Telescopes, from 6" to largest size. Observatory Domes, all sizes. Warner & Swasey, Cleveland, O.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Minerals sent for examination should be distinctly marked or labeled.

(1) A. P. W. asks: In a set of bevel gear cog wheels, the largest 5¾ feet in diameter, and the smallest 2 feet in diameter, how many revolutions will the small wheel make while the large one is making one revolution? A. 2⅞ revolutions of small wheel to one of the large. Better count the teeth of the wheels and divide the larger by the smaller. We have no data relative to the horse power of a spring.

(2) C. W. O.—There are a few tall chimneys in England and Scotland that were built too slender, and are affected by high winds. Brick and mortar are elastic to a certain degree, like glass or stone, and the tall chimneys sway within the limits of elasticity. The amount of deflection you state is probably overrated. You may safely divide it by 3 for a 400 foot chimney.

(3) D. H. asks: 1. What would cause gas to consume in a stove, and explode every few minutes? A. Carbonic oxide gas from coal coming in contact with air while hot takes fire. Sometimes the air mixes with the gas before ignition takes place, when an explosion follows. This often occurs when the door is slightly open. 2. While crossing a pond, I dropped my knife in the water, and after fishing it out, it was covered with a fine black sand. What kind of sand was this? What did it contain? A. The black sand was probably magnetic oxide of iron, which is often found as fine sand. Several attempts have been made to use it as iron ore, but without profit. 3. Does smoke contain iron? A. Smoke contains no iron.

(4) W. L. H.—It is customary and proper to connect valves to close against the source of the steam so as to allow of the stuffing box of the spindle to be packed at any time.

(5) G. R. D. writes: In regard to bichromate battery, I have six 1 gallon cells and eight half gallon cells. In the gallon cells I use carbons and zincs 6x3 inches; in the half gallon cells, carbons and zincs 4½x2½ inches. Now, suppose I want to use all these in one circuit, what arrangement will generate the most electricity in proportion to the amount of electropoion fluid required? Would the outfit be equal only to 14 half gallon cells? Would filling the gallon cells half full and using 6x3 carbons and zincs make them equal to the half gallon cells? A. You should connect your 1 gallon cells in series, and your half gallon cells in pairs, arranged in parallel circuit, two of your half gallon cells arranged in this way being about equal to one 1 gallon cell. Your battery arranged in this way would be equal to ten 1 gallon cells. We do not think that half filling the larger cells would answer the same purpose.

(6) R. M. asks: 1. Would the cell of battery illustrated in issue of April 11, 1885, do for an electric medical apparatus? A. Yes. 2. What is meant by interrupter in answer to query 3, issue January 11, 1886? A. Anything that will rapidly break and complete the circuit will answer the purpose. Commonly, a vibrating spring carrying at one end an armature, which is placed in front of the core of the coil, and having on the back thereof a contact point, is employed for this purpose. The attraction of the core of the coil for the armature carried by the spring holds the spring away from its electrical contact and breaks the circuit, when the core of the coil immediately loses its magnetism, and the retractile force of the spring carries it back to the contact point, again completing its circuit, when the current again flows through the primary wire of the induction coil, the armature is again attracted, and the circuit is again broken. This operation is rapidly repeated.

(7) G. W. C. writes: I wish to light a store with electricity, if it does not cost too much, and I know of no other source to obtain the information, and you will favor me greatly by answering the following questions: Can a store 60 feet by 24 feet be lighted, with a battery for generator? What will be the probable cost of each lamp? Also, what will be the cost to maintain? Please refer me to the builder of such lamps. A. It can be done, but it would be far more expensive than to employ a steam engine and dynamo. Any of the principal manufacturers of electric lamps can supply you. Consult our advertising columns.

(8) A. V. P.—The milkiness of the glass of your aquarium is probably caused by the decomposition of the surface by long contact with water and the vegetable growth on its surface. It may be repolished with rouge on a piece of soft leather, wet with water. Otherwise you must use new glass.

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(9) S. D. writes: I have a basement which I use in making ice cream; have a good deal of water and ice about, and heavy tubs and barrels, and I wish to put in a floor of cement or asphalt, or something of the kind. A. Asphalt, coal tar, and sand makes the best floor for such purposes. Melt the asphalt and coal tar equal parts in a large kettle. Heat the sand on a large iron pan, and mix 1 part asphalt and tar to 4 parts sand, hot, and spread quickly.

(10) W. C. M. writes: I built a dynamo machine three times larger than the one explained in SUPPLEMENT, No. 161. I wound the fields in 8 layers of No. 16 double wound cotton wire, the armature with No. 18 single wound. By connecting a brush and a field together, and running the remaining brush and field to the lamp, I cannot get a current strong enough to get the carbon in a 16 candle power incandescent lamp red. By connecting a brush and field and the other brush and field together, and then running two lines from them to the lamp, the current is just sufficient to get the carbon red in the lamp; but by connecting the brushes and fields together in this way produces too much sparking, and that burns the brushes and commutator up. Would it do to wind the field and armature with smaller wire? If so, what number would you recommend? Would it make any difference in decreasing the width of the commutator from 1⅛ to ⅝ inch? Should I not get one 16 candle power incandescent lamp out of the machine described? What is the trouble with my machine? A. Have you tried connecting two lamps in parallel circuit, so as to reduce the resistance of your external circuit, and cause some of the current to pass through the lamps, and less through the field magnet? Probably your machine would run two or three lamps connected in parallel circuit better than it could run one lamp, as your machine is probably incapable of producing a current which will overcome the resistance of a single 16 candle power lamp. We would not advise you to wind your machine with finer wire. If you should not succeed in operating two 16 candle power lamps with your machine, try a larger number of smaller lamps connected in parallel circuit. From your description we think there is no trouble with your machine.

(11) E. N. H. says: Metallic railway ties are about to be experimented with on the Maine Central Railway, and the Boston and Maine Railroad has had a section laid with steel ties in use for the past six months.

(12) H. L. G. asks if a simple and practical apparatus for detecting and showing the degree of vitiation of air contained in apartments has ever been presented to the public. A. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 259, illustrated.

(13) N. T. asks how to put up matches to stand a damp climate. A. In moist climates, like England, less phosphorus and more chlorate is used, which imparts a snapping and flaming quality. The following is an illustration of the English composition for tipping:

Fine glue	2	parts.
Water	4	"
Phosphorus	1½ to 2	"
Potassium chlorate	4 to 5	"
Powdered glass	3 to 4	"

Red or white lead or smalt, sufficient to color. The glue, broken in small pieces, is soaked in water till soft, added to the water, and dissolved by means of a water bath. The vessel is removed from the fire and the phosphorus is gradually added, the mixture being constantly agitated with a suitable stirrer. When a uniform emulsion is obtained, the other substances are mixed in one after the other, in the order in which they are named above, and the stirring is continued until the mixture is nearly cold. The best qualities of matches have their tips protected by a thin coat of copal varnish.

(14) G. S.—People losing their hearing generally lose the faculty of intelligent speech, though many retain considerable facility of expression from their memory of lingual effort and observation of the lips of others.

(15) D. McK. writes: I have a small coal-burning stove in my dining room in which I burn coke. I am told that it is dangerous without the best of ventilation, as the deadliest of gases are generated from the coke. A. Your coke stove is all right if you have a stovepipe as used for burning coal. Good coke is healthier than poor coal.

(16) J. F.—The slight variation in the tables as given by different authors in stating the latent and sensible heat of steam arises from the use of original formulas of different investigators on the properties of steam. The tables of any one author are sufficient for all practical purposes. We recommend Nystrom's Mechanics' and Engineers' Pocket Book, last revised edition, 1885, $3.50, which we can furnish.

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February 9, 1886,

AND EACH BEARING THAT DATE.

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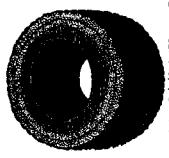
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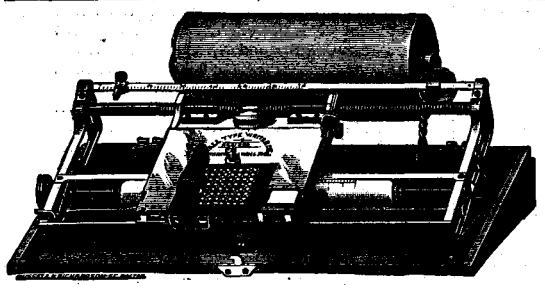
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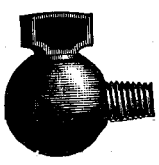
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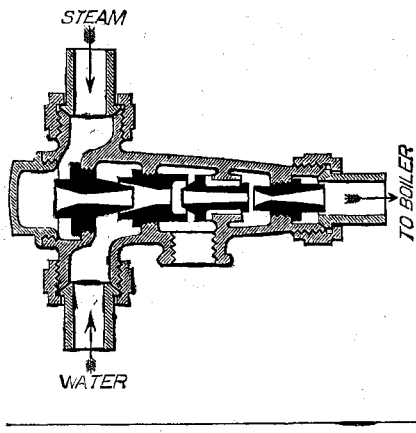

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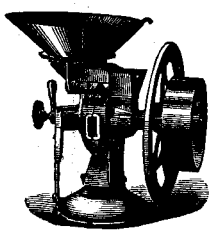

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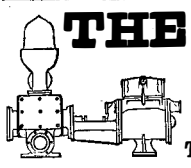

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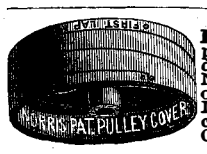

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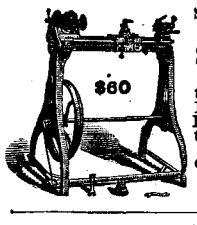

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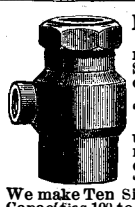

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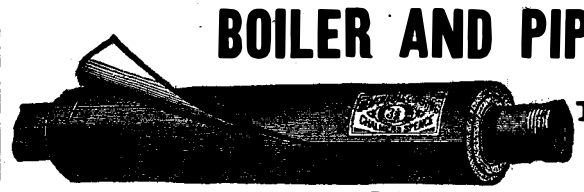

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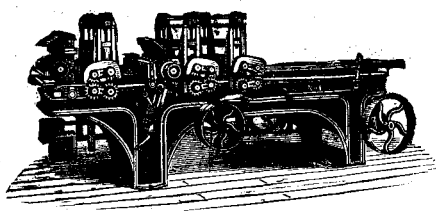

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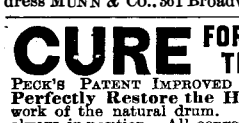

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Inside Page, each insertion - - - 75 cents a line.
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FROM THE
FORTY-FIRST ANNUAL REPORT
OF THE
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Interest income, over three million dollars, being about 5¼ per cent. on average net assets, and nearly four hundred thousand dollars in excess of losses by death.

Market value of securities, over three million three hundred thousand dollars in excess of their cost.

Liabilities, both actual and contingent, provided for, and a Divisible Surplus by the Company's standard of over seven million dollars; Surplus by the State standard, over thirteen million dollars.

An increase of nearly two million dollars in income, over three millions in surplus, over seven millions in assets, and of over thirty millions of insurance in force, during 1885.

SUMMARY of REPORT. BUSINESS of 1885.

Received in Premiums	$12,722,103.03
Received in Interest, Rents, etc.	3,399,069.71
Total Income	**$16 121,172.74**
Paid Death-claims	$2,909,109.64
" Endowments	741,764.47
" Annuities, Dividends, and for Policies purchased	3,940,999.64
Total Paid Policy-holders	**$7,681,873.75**
New Policies Issued	18,566
New Insurance Written	$68,521,452.00

CONDITION JAN. 1, 1886.

Cash Assets	**$66,864,321.32**
*Divisible Surplus, Co.'s Standard	$7,064,473.13
†Tontine " " "	3,123,742.77
Total Surplus, " "	**$10,188,215.90**
Surplus by State Standard,	**$13,225,053.94**
Policies in Force	86,418
Insurance in force	$259,674,500.00

PROGRESS IN 1885.

Excess of Interest over Death-losses,	$399,960.07
Increase in Income	1,880,697.35
Increase in Surplus, State Standard,	3,313,707.48
Increase in Assets	7,580,567.75
Increase in Insurance Written	7,036,902.00
Increase in Insurance in Force	30,291,914.00

* Exclusive of the amount specially reserved as a contingent liability to Tontine Dividend Fund.
† Over and above a 4 per cent. reserve on existing policies of that class.

THE SEVEN ADVANTAGES
OF THE
New York Life Insurance Company's
NON-FORFEITING-TONTINE LIMITED ENDOWMENT POLICY.

FIRST ADVANTAGE.—Insurance for a definite amount, or for an amount increasing with each premium paid, as desired.
SECOND ADVANTAGE.—A Definite Cash Endowment, and a Tontine Dividend, to Policies in force at the end of Endowment and Tontine periods, which periods correspond, and may be either Ten, Fifteen, or Twenty Years.
THIRD ADVANTAGE.—Insurance for the full amount of the Policy, extended for as long a time as the value of the Policy will carry it, within the Endowment period, in case of discontinuance of payment of premiums after three years.
FOURTH ADVANTAGE.—A Grace of one month in the payment of premiums, during which time the policy holder's security is unimpaired.
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SIXTH ADVANTAGE.—Practical freedom of action with respect to occupation, residence, and travel.
SEVENTH ADVANTAGE.—The payment of death claims immediately upon the approval of the required proofs of death.

Do not insure until you have seen full particulars of this Policy. Do not fail to write the nearest Agent or the Home Office for such particulars—at once. The NEW YORK LIFE INSURANCE COMPANY, 346 & 348 Broadway, New York City.

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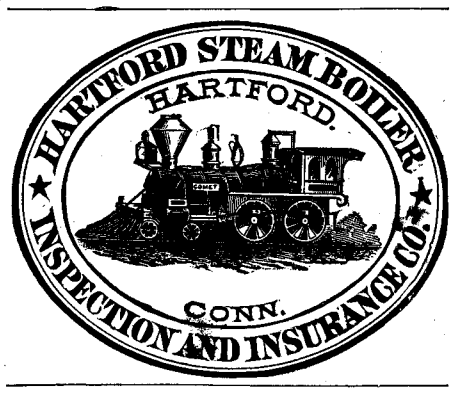

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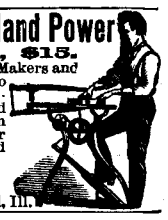

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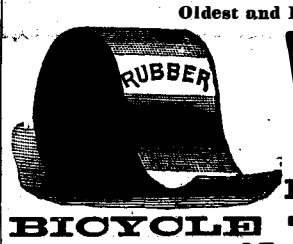

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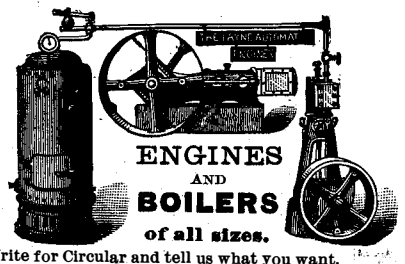

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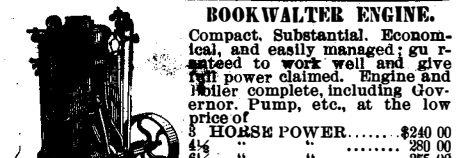

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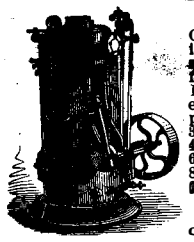

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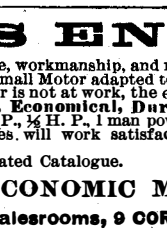

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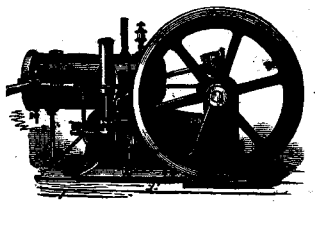

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